SCIENCE ABSTRACTS.

Section A.—PHYSICS.

JULY 1906.

GENERAL PHYSICS.

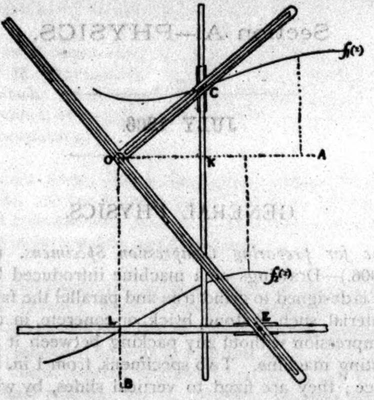
1171. *Machine for preparing Compression Specimens.* (Engineering, 81. p. 756, June 8, 1906.)—Drawings of a machine introduced by the Riehlé Co. are given, which is designed to grind true and parallel the faces of a specimen of a granular material, such as stone, brick, or concrete, in order that it may be tested in compression without any packing between it and the pressure plates of the testing machine. Two specimens, from 1 in. to 3 in. cube, can be ground at once; they are fixed to vertical slides, by whose weight they are pressed upon a horizontal disc, 2 ft. 6 in. diam., revolving at 40 r.p.m., fed with sand and water; at the same time they are slowly reciprocated across the face of the disc by a crank and connecting-rod mechanism.

F. R.

1172. *A Friction Effect.* **E. Guyou.** (Comptes Rendus, 142. pp. 1055–1056, May 14, 1906.)—On rotating a spherical glass shell full of water and containing particles of solid matter, the latter arrange themselves along the axis if their density is less than that of water, but if their density is greater than that of water they arrange themselves upon two small circles parallel to and equidistant from the equator. To explain this the author considers the forces acting on a particle. The centrifugal force due to rotation is opposite to and greater than the fluid pressure, also due to rotation. The particle thus moves radially until it meets the glass shell. If the angle between its path and the normal to the surface at the point of contact is greater than the angle of friction the particle slides along the glass, but if this angle, which is equal to the "latitude" of the particle, is equal to or less than the angle of friction the particle remains in contact with the glass. Thus all particles which first touch the glass at points whose latitude is greater than the angle of friction, slide along the glass until they reach a parallel whose latitude is equal to the angle of friction. The force due to gravitation is generally negligible compared with that due to rotation.

S. G. S.

1173. *An Integrator of Ordinary Differential Equations.* **A. Kriloff.** (Acad. Sci. St. Pétersbourg, Bull. 20. pp. 17–37, Jan., 1904. Zeitschr. Instrumentenk. 26. pp. 126–128, April, 1906. Abstract.)—The author proposes to modify Kelvin's mechanical integrator by the addition of two auxiliary mechanisms, viz., a *multiplier* and an *equaliser*. The former, which is to automatically multiply together two variable quantities, consists of a bent lever COE with slotted arms at right angles, which turns about a pivot O that is movable along a fixed line OA. C is a peg fixed on a rod KC which can slide through a collar at K perpendicular to OA and rigidly attached to the pivot O at distance OK = 1, and, while O is moved along OA, the peg C which engages in the slot OC is constrained to move along a template whose ordinates measured from OA represent one of the variables. Through a collar at L that can slide along the line OB, perpendicular to OA, passes a rod LE which can slide parallel to OA, and a fixed peg E upon it engages in the slot OE while the collar moves along a template whose ordinates measured from OA denote the second variable. The length LE then denotes the product of the two variables. The equaliser is to maintain constant the sum of a number of variables: it is merely Kelvin's tide-predicting mechanism worked backwards. R. E. B.



1174. *Effect of Speed in the Law of Deformation of Metals.* **P. Vieille** and **R. Liouville.** (Comptes Rendus, 142. pp. 1057–1058, May 14, 1906.)—Galy-Aché and Charbonnier have established that a metal crusher, such as is used for indicating the pressure of an explosion, has, after rapid deformation in use, and upon returning to its initial temperature, a resistance to crushing which is superior to that of a similar crusher which has been equally strained statically. The authors of the present note remark that this observation, showing that the speed affects the amount of deformation, indicates also that no function of the deformation (E) and the speed of deformation (E′) will represent the resistance (R) of the crusher. Their experiments, however, have led to a satisfactorily approximate relation between dE, dE′, and dR; these results will be published later. F. R.

1175. *Relation between Stretching and Torsion of Thin Wires.* **G. Ercolini.** (N. Cimento, 11. pp. 43–79, Jan. and Feb., 1906.)—The effect of stretching and twisting a wire simultaneously is investigated experimentally, copper wire being used throughout. The first part of the paper contains a detailed description of the apparatus and the method of making observations. The couples and forces are applied sinusoidally and can be arranged to be in phase with each other or to differ in phase by 60°, 120°, or 180°. The results are exhibited in tables and curves, and of the many conclusions come to the following may be noted. The greater the amplitude of the torsion the more the curves present the characteristics of the pure torsion curves, and *vice versâ*. Although maxima and minima in the extension occur, this becomes greater and greater with succeeding cycles. Both increasing and decreasing cyclical torsion produce elongation of the wire. The cycles of torsion vary very little in area, and the curves of couple and azimuth which represent them are subjected to displacement with respect to the azimuth axis, chiefly due to the variation in length of the wire. The elongation diminishes with increasing difference of phase. The accommodation is more rapid in the simple than in the double deformation and when small rather than large forces are applied. S. G. S.

1176. *Effect of Low Temperature on Recovery of Steel from Overstrain.* **E. J. McCaustland.** (Amer. Inst. Mining Engineers, Bull. 9. pp. 447–466, May, 1906.)—The author tested specimens of a "soft" and a "mild" steel, first overstraining them very slightly, then treating them as shown in the following table; the degree of recovery was determined at intervals by loading to a point slightly beyond the original elastic limit, and unloading ["cyclical loading"], the stress-strain curve forming a hysteresis loop, whose width diminished as elasticity was recovered. The "low temperature" in the table was that of a refrigerator-room, and was always below 32° F. The treatment in the steam bath, at atmospheric pressure, lasted for ½ hour.

No.	Steel.	Original Elastic Limit, lbs. per sq. in.	Overstrain, inches in 8in. length.	Hours at Low Temperature.	Time of Recovery, Hours.	
					At Atmospheric Temperature.	At Atmospheric Temperature, after Steam Bath.
1	Soft	27,500	0·0339	None	68	—
2	Soft	28,000	0·0366	None	69	—
3	Mild	32,000	0·0632	None	434	—
4	Mild	32,000	0·0372	None	359	—
5	Soft	28,000	0·0517	None	—	25
6	Soft	28,000	0·0512	None	—	26
7	Mild	30,000	0·0129	None	—	24
8	Mild	30,000	0·0147	None	—	119
9	Soft	27,000	0·0244	2,112	142	—
10	Soft	27,500	0·0462	4,727	120	—
11	Mild	30,000	0·0206	2,707	—	93
12	Soft	28,500	0·0468	2,111	—	24

The time of recovery of No. 3 appears to be greater than that of No. 4 on account of the former having been overstrained to a greater extent. That of No. 8 is greater than that of No. 7, possibly owing to the fact that the stress reached a higher value in the cyclical loading of the former The results from the first eight specimens confirm those of other workers (particularly Ewing and Muir), and also indicate that recovery is slower in the steel containing more carbon. The low-temperature treatment appears, whilst it lasts, absolutely to prevent recovery from overstrain—which confirms Coker's results [Abstract No. 227 (1903)]—and further greatly to retard recovery on restoration of atmospheric temperature. F. R.

1177. *Moduli of Elasticity of Constructive Materials.* **J. E. Howard.** (Eng. Record, 53. p. 658, May 26, 1906.)—The following values of the moduli of elasticity, in millions of lbs. per sq. in., have been calculated from data given in the Report of Tests made at Watertown Arsenal. Steel 29·5 to 30; wrought iron, 26·8; cast iron, 14·3 to 18; bronze (not specified), 10 to 14·3; granite, 5 to 9·8; marble, 4 to 15; limestone, 4 to 14·7; slate, 16·2; bluestone, 7; sandstone, 1·1 to 4; bricks, hard, 10; bricks, light hard, 4·5; bricks, salmon, 0·5; Portland cement, 4; natural cement, 1·1; long leaf pine, butts, 2·2; long leaf pine, tops, 1·6; short leaf pine, 1·5; Douglas fir, 1·8; spruce, 1·5; white oak, 1·5. F. R.

1178. *Recent Tests at Watertown Arsenal.* (Page's Weekly, 8. pp. 1210–1211, June 1, 1906. From Annual Report of Tests of Metals, &c., made with the U.S. Testing Machine.)—The following were the contractions in inches per inch, observed upon cooling, from 70° F. to liquid-air temperature, a series of steels of given composition, having the respective carbon percentages indicated below :—

Carbon, per cent...	0·16,	0·34,	0·55,	0·73,	0·82,	1·09
Contraction.........	0·00180,	0·00180,	0·00177,	0·00191,	0·00183,	0·00184

A 0·17 per cent. carbon steel tested at ordinary temperature had an elastic limit of 52,800 (80,000) lbs. per sq. in., 72,000 (97,600) lbs. per sq. in. tensile strength, elongation 29·3 (10·7) per cent. on 3 in., and 54·6 (47·2) per cent. contraction; the corresponding figures at liquid-air temperature are given in brackets. Tests of the "soft," "polished," and "ground" types of roller bearings of the Standard Roller Bearing Co., each having 15 rollers of 0·43 in. diam., and 3·9 in. long, were carried out by running each bearing in the hub of a lead wheel of 40 in. outside diam. weighing 3,015 lbs., at 21 r.p.m. The bearings ran respectively 12,096, 2,520, and 53,088 revs. before pulling up and causing the driving belt to run off. The surfaces of rollers and sleeves of the "soft" bearing were damaged, but the others were in good condition when cleaned, each being clogged with abraded metal. F. R.

1179. *Strains produced by Surface Loading over a Circular Area.* **H. Nagaoka.** (Physico-Mathematical Soc., Tokyo, Proc. 3. 4. pp. 75–78, 1906.) —In order to estimate the strains produced on the earth's surface by rainfall or changes of barometric pressure a calculation is made of the strains produced by surface loading of a circular area of radius R. If $\beta \equiv 1/4(\lambda + \mu)$ and $\gamma \equiv (\lambda + 2\mu)/\pi\mu(\lambda + \mu)$, it is found that at a distance a from the centre of the area a uniform pressure p on the area causes a horizontal displacement of $-\beta p R^2/a$ or $-\beta p a$ and a vertical displacement of [E, K, elliptic integrals]

$$\gamma p a[\mathrm{E}(\mathrm{R}/a) - (1 - \mathrm{R}^2/a^2)\mathrm{K}(\mathrm{R}/a)] \quad \text{or} \quad \gamma p \mathrm{R}\mathrm{E}(a/\mathrm{R}),$$

according as $a \gtrless \mathrm{R}$. The horizontal displacement is thus a maximum at the periphery of the circle, but the vertical displacement is, as we should expect, maximum at the centre. The much more complicated distribution of strain when the pressure on the area diminishes from the centre outwards by an amount proportional to an even power of the distance from the centre is also calculated. It thus appears that if the area of pressure is confined to a small portion of the surface, both strain-components practically vanish in its immediate neighbourhood; but the strained area increases almost in the same ratio as the stressed region, so that in the actual problem of barometric change or rainfall the effect would also be felt in places apparently remote from the places subjected to differences of surface pressure. R. E. B.

1180. *Stationary Surface Waves.* **H. Nagaoka.** (Physico-Mathematical Soc., Tokyo, Proc. 3. 4. pp. 79–82, 1906.)—The strains produced on the earth's crust by variations of pressure on limited areas extend to regions quite remote from the stressed areas, and stationary waves must result from periodicity in these variations. These are investigated, the effect of gravity being neglected, and it appears that the stationary waves between two parallel planes in an isotropic solid completely resemble those in rods with similar boundary conditions. R. E. B.

1181. *Coefficient of Viscous Traction and its Relation to that of Viscosity.* **F. T. Trouton.** (Roy. Soc., Proc. Ser. A. 77. pp. 426–440, May 14, 1906.)—The relation between the flow of a viscous material and the stresses applied to it is investigated by four experimental methods. In the first a rod of material is subjected to traction and its rate of elongation determined. The relation $(F/A)/(dv/dx) = \lambda$ is found to apply, where F is the tractive force, A the area of cross-section, v the velocity of a point whose ordinate parallel to the axis of the rod is x, and λ is a quantity called by the author, the coefficient of viscous traction of the material, and which is constant for any given substance. The rate of elongation becomes constant after the load has been applied for about 20 min., but has a slightly greater value until this time has elapsed. On removing the force a slight movement of recovery is observed. In the second experiment a cylinder is compressed axially, and the results are in accord with those of the first. The third method consists in determining the form of a stream of the substance descending under its own weight from a circular hole in the bottom of the containing vessel. The form of the descending stream is calculated in terms of λ for the case in which the velocity is so small that the acceleration term in the equation of motion may be neglected. The form determined experimentally is in good agreement with that calculated, and the resulting values of λ agree well with those of the first two methods. In the last method the rate of sagging of a horizontal beam is determined. This method suffers from the same defect as that met with in determining the coefficient of viscosity by a torsion method [see Abstract No. 1248 (1904)], that the rate of flow varies from zero at some points to a maximum at others. The author then shows that the coefficient of viscous traction should be three times the coefficient of viscosity for any given material, and determinations of both quantities with a variety of mixtures of pitch and tar, and with shoemaker's wax are made, the method of experiment being chosen in each case in accordance with the nature of the substance. The table shows the agreement of the experimental with the theoretical result in several cases.

λ.	μ.	λ/μ.	λ.	μ.	λ/μ.
$4{\cdot}3 \times 10^{10}$	$1{\cdot}4 \times 10^{10}$	3·07	$6{\cdot}7 \times 10^{9}$	$2{\cdot}2 \times 10^{9}$	3·04
$3{\cdot}6 \times 10^{10}$	$1{\cdot}0 \times 10^{10}$	3·60	$5{\cdot}9 \times 10^{6}$	$2{\cdot}0 \times 10^{6}$	2·95
$3{\cdot}3 \times 10^{10}$		3·30	$9{\cdot}3 \times 10^{5}$	$2{\cdot}8 \times 10^{5}$	3·25
$12{\cdot}9 \times 10^{9}$	$4{\cdot}2 \times 10^{9}$	3·07	$7{\cdot}6 \times 10^{5}$	$2{\cdot}6 \times 10^{5}$	2·91

S. G. S.

1182. *Molecular Forces in Gelatine.* **A. L. Foley.** (Science, 23. pp. 790–791, May 18, 1906.)—On placing a drop of a solution of gelatine in warm water upon the face of a glass prism, the author found that in drying, the piece of glass lying immediately under the gelatine is torn from the prism. Thus the contractile force of the gelatine and the adhesive force of gelatine and glass are greater than the cohesion of the glass. The experiment is repeated with other kinds of glass; when the surface of the glass is carefully cleaned, the same result follows. S. G. S.

1183. *Capillary Layer.* **G. Bakker.** (Ann. d. Physik, 20. 1. pp. 35–62, May 11, 1906.)—The theory of a capillary layer [see Abstract No. 378 (1905)] is here applied to explain the abrupt change of thickness at the border of a black spot in a soap-film. It is supposed that on either side of the film, when thick enough for its central layer to be in the homogeneous liquid phase under purely hydrostatic pressure, there is a continuous drop of density outwards with corresponding variation of pressure so that all the phases represented by J. Thomson's isothermal occur in order (the possibility of this structure is assumed without any discussion of its stability), that as the film is extended and its thickness diminished the phase of homogeneous liquid first disappears and then the others in turn until the central layer reaches the phase corresponding to the beginning of the unstable stage for the fluid when homogeneous, after which an abrupt jump to the phase corresponding to the end of the unstable stage is made, this entailing the observed abrupt change of thickness. [The mechanics of the boundary of a black spot where this abrupt change occurs need special investigation on these assumptions.] It is then concluded that, while normally to the film there is at all layers a pressure equal to the vapour pressure, there are tensions along the layers, the average of which in the case of water is about 76 atmos., but, perhaps, amounting to over 150 atmos. in the black spots. The connection between these tensions and the form of the theoretical isothermal, their variations from point to point, and also with temperature, and the properties of the point within the layer at which the thermodynamic potential has the same value as that for the homogeneous liquid and vapour phases are then discussed on the assumption of a potential function of form $-(f/r)\exp.(-qr)$, where q is large. R. E. B.

1184. *Motion of freely falling Bodies.* **de Sparre.** (Annal. Soc. Sci. de Bruxelles, 30. pp. 203–222, 1906.)—The earth's surface being taken to be an oblate spheroid and also a level surface, on which $g = \gamma + a\sin^2\lambda$, where λ denotes latitude, the author finds $(2\omega^2h^2/3g)(1 - a/2R\omega^2)\sin\lambda\cos\lambda$ for the southward, and $\surd(8\omega^2h^3/9g)(1 - \mu^2h^2/56)\cos\lambda$ for the eastward deviation of a body which falls through a height h. Here μ depends on the air resistance, and for a homogeneous sphere of radius a cm. and density ρ is $0{\cdot}015/a\rho$. [See Abstract No. 508 (1905).] R. E. B.

1185. *Gravitation and Electromagnetism.* **F. Wacker.** (Phys. Zeitschr. 7. pp. 300–302, May 1, 1906.)—Lorentz' explanation of gravitation, in which the effect of velocity on the action between electrons is taken into account, is here reconsidered with the added consideration, pointed out by Wien, that the velocity also affects mass, and applied to the motion of the planet Mercury. The resulting calculation is irreconcilable with observation unless the magnitude and direction of the absolute velocity of the solar system is different from that usually assigned to it. The question arises whether any value for this velocity can be determined so as to satisfy the theory and also the observed motions of all the planets. R. E. B.

1186. *Centrifugal Ventilator.* **H. Bochet** and **L. Bochet.** (Comptes Rendus, 142. pp. 990–992, April 30, 1906.)—An experimental study of a ventilator of the Capell type verifies the inventor's claim that in certain cases its efficiency, as measured by the ratio of the kinetic energy of the air as it is sucked into the ventilator to the motive work, is greater than 1; it was, indeed, found sometimes to rise to 1·67. The efficiency should, however, really be measured by the ratio of the kinetic energy of the *issuing* air to the motive work, and this never exceeded 0·6. It further appears that the coefficient of contraction of a gaseous vein sucked through an orifice in a thin wall is not uniformly 0·65, as usually taken, but depends on the size of the orifice, rising to 0·8 for orifices larger than 1 sq. dm. in section and falling to 0·4 for orifices that are exceedingly small. R. E. B.

1187. *Thermodynamics of the Atmosphere.* I. *Asymmetric Cyclones and Anticyclones in Europe and America.* **F. H. Bigelow.** (Monthly Weather Rev. 34. pp. 9–16, Jan., 1906.)—Referring particularly to the temperature distributions up to 4,000 and 6,000 m., as observed at Blue Hill and other stations in America, and at Hald and Berlin in Europe, the author argues that there are no true local warm-centred or cold-centred cyclones, and that there is no fundamental difference between American and European cyclones. Currents of different temperatures from warm and cold latitudes intermix; the centres of gyration lie on the boundaries and not in the midst of those counter-currents, and represent the dynamic effects of thermodynamic energy. The primary cause of the storm is rather horizontal convection, interchange of heat energy on the same level, than vertical convection. There is no evidence of the superposition of cold-centre cyclones upon warm-centre cyclones (as suggested by Clayton, Bjerknes, Arrhenius), nor of purely dynamic vortices in rapid stream (Hann); nor are there cyclonic vortices caused by atmospheric islands of high pressure obstructing the rapidly-flowing eastward drift (Shaw, Hildebrandsson). H. B.

1188. *The Beaufort Scale of Wind Force.* (Nature, 74. pp. 106–107, May 31, 1906. Report.)—On the scale proposed a hundred years ago, when there were no mechanical anemometers, by Admiral Beaufort, a calm was zero, a bad hurricane 12, and the intermediate numbers were assigned according to the amount of sail which a ship of specified rig could carry. As the rigging has undergone many changes, the correlation between anemometer velocities and the Beaufort scale was much disputed, and the director of the Meteorological Office, W. N. Shaw, has now issued a report which is supplemented by G. C. Simpson, G. H. Darwin, W. H. Dines, and Hepworth. There are great difficulties. It had been assumed that the actual wind velocity was three times the velocity recorded by the Robinson cups; according to measurements made with the Dines pressure-tube, the factor 2·2 or 2·1 would be more correct. Then the Köppen and the Curtis scales of Beaufort equivalents differed; Simpson deals with this question. H. B.

1189. *Meteorological Phenomena on Mountain Summits.* **S. P. Fergusson.** (Science, 23. pp. 672–674, April 27, 1906.)—Although in recent years many meteorological investigations of the upper air have been made by means of kites and balloons, much of our knowledge of the higher regions has been the result of observations on high mountain summits. The chief error arising in connection with these latter is caused by the unknown action of the mountain mass itself upon the meteorological conditions in its vicinity, and the results from observations in the free air do not show the same vertical changes that are observed on mountains, the diurnal periodic change of temperature noticeable on all mountain stations quite disappearing at a height of about 1,000 m. in the free air. During the last week in August, 1905, comparisons were made of the weather conditions on Mount Washington N.H., with those of the neighbouring free air, by means of kites flown in the Ammonoosue Valley, 16 km. west of and 1,500 m. lower than the summit of the mountain. The valley is open to the west, from which direction the prevailing winds chiefly come. Four uniformly constructed meteorographs were employed, registering temperature, pressure, humidity, and wind velocity, on a paper drum revolving once in 12 hours. The results indicate a decidedly lower temperature and a much higher wind velocity on the mountain than in the free air. [See also Abstract No. 253 (1906).] C. P. B.

1190. *Earth Temperatures on the Assumption of Radio-active and Chemical Processes.* **J. Koenigsberger.** (Phys. Zeitschr. 7. pp. 297–300, May 1, 1906.)—The temperature gradients in a sphere due to exothermic processes are considered for the cases that the heat is generated (1) equally throughout the sphere, (2) in a surface layer of definite thickness, (3) in an internal layer of definite thickness, and it is concluded that, in order to represent the observed facts as to the earth, Fourier's theory must be supplemented by the assumption of heat generation which falls rapidly as the depth increases: the constancy of the temperature gradient while the conductivity diminishes with rise of the temperature can thus be accounted for. But whether this diminution of heat production is conditioned by diminution in quantity of radio-active substances or otherwise cannot yet be determined. For the very small depths, however, that specially concern us, it is immaterial whether we take radio-activity into account or not. R. E. B.

1191. *Dilatational Stability of the Earth.* **Rayleigh.** (Roy. Soc., Proc. Ser. A. 77. pp. 486–499, May 14, 1906.)—The theory of elastic solids, both generally and as applied to the earth, usually proceeds on the assumption that the body is initially in a state of ease, free from stress and strain. This cannot be the case, and it is more satisfactory to start from the condition of the earth as actually stressed by its self-gravitation. The stresses are doubtless enormous, but, as they are of the nature of purely hydrostatic pressure, there is no reason to doubt that the reaction is purely elastic, and that the material preserves its integrity. And there is no occasion, on this account, to object to the application to this case of the usual elastic theory for bodies in a state of ease if only allowance is made for the altered values of the elasticities, as is shown by the expression for the potential energy of strain: there is, for instance, every reason for believing that in virtue of cohesional forces the interior of a drop of water is under pressure not insignificant even in comparison with those prevailing inside the earth. Starting from Jeans' equation and assuming the dilatation to vary harmonically with the time, so that in a particular case it is proportional also to the product of a spherical surface function of order n and a Bessel function of order $n + \frac{1}{2}$, the author uses a method formerly employed by Lamb to discuss the vibrations of an elastic sphere, and the criteria of stability are determined for $n = 0$ and $n = 1$. The result in the latter case does not agree with that given by Jeans, though it is deducible from his equations. Lastly, it is noted that the immediate geological effect of denudation may be to lower the surface level, but that, if the material removed be heavy and the substratum very compressible, the springing up of the foundation may more than neutralise this first effect and leave the new surface higher than the old one. R. E. B.

1192. *Mineralisation of Underground Water and its Electrical Resistance.* **F. Dienert.** (Comptes Rendus, 142. pp. 1113–1115, May 14, 1906.)—The electrical resistance, as measured by the Kohlrausch method, of the very pure water from the several springs which supply Paris, keeps on the whole very constant, and has varied under normal conditions since 1903 only between 2·350 and 2·375 ohms. An increase in the resistance by 50 ohms may hardly show in the chemical analysis. Changes are produced by subterranean causes and by infiltration of surface water. In one case the water was turbid for 72 hours and at the same time the resistance rose from 3·808 to 4·055 ohms; in another case the level of a spring sank and the resistance decreased from 2·76 to 2·71 ohms. Contamination with surface water, noticeable for about a fortnight after rains, may raise the resistance to 200 ohms. Low-resistance water hardly contains any germs of *b. coli communis.* H. B.

1193. *Variation of Latitude*, 1890–1905. **H. Kimura.** (Physico-Mathematical Soc., Tokyo, Proc. 3. 3. pp. 68–71, 1906.)—The author gives the results of a harmonic analysis of the polar motion and the correlating phenomena during the past 15 years. It is assumed that each of the rectangular components of the polar motion may be expressed as the sum of a certain number of simple harmonic functions of time, of which the periods are mutually different. The chief conclusions are: (*a*) The 14-months' motion is generally an ellipse and not a circle; (*b*) the gradual changes of the elements of the ellipse are traceable, but their law of variation is difficult to determine; (*c*) there is a new, nearly rectangular motion, with a period of about 0·75 year. [See also Abstract No. 692 (1906).] C. P. B.

1194. *Long Period of the Sun's Activity.* **A. Hansky.** (Acad. Sci. St. Pétersbourg, Bull. 20. pp. 145–148, April, 1904.)—The data from 1750 are analysed in the attempt to deduce the true value of the period of about 72 years. The actual length of the periodicity appears to oscillate from about 69 to 75 years, and the intervals between maxima and their following minima are *longer* than those between minima and their following maxima, the first set of intervals being 40·2 and the second 31·5 years. There appears to have been a disturbance of the periodicity about 1860, but this may have been introduced by the greater accuracy of observation introduced about that time by the application of photography. C. P. B.

1195. *Measurement of the Sun's Rotation.* **J. Halm.** (Roy. Soc. Edinburgh, Proc. 26. pp. 76–86, 1905–1906.)—This research was undertaken with the view of ascertaining whether the peculiar view of surface rotation of the sun, first discovered by Carrington and confirmed later by Duner, was or was not subject to alterations depending on the general state of solar activity. By a special arrangement of the discussion the resulting measures of the shifts of a pair of solar lines with respect to a pair of terrestrial (atmospheric) lines, either the rotational velocity of the sun's limb may be computed or the corrections depending on the earth's position in space. For instance, the annual correction, depending on the earth's vector movement, is shown by a curve to have a maximum retrògression from the sun in spring and a maximum velocity of approach in autumn. The amplitude of this change corresponds to a change of wave-length of about 0·01 tenth-metre. From the character of this velocity curve a curious phenomenon is described, in which the turning-points show a progressive alteration from 1901 to 1903; this dies down somewhat during 1904, but again appears in the observations for 1905. No explanation can at present be suggested for this peculiarity. Other curves are given showing the evaluation of the diurnal correction due to the earth's rotation. C. P. B.

1196. *Photographs of the Solar Granulation.* **W. E. Rolston.** (Nature, 73. pp. 401–402, Feb. 22, 1906.)—The article contains a *résumé* of A. Hansky's paper giving details of his recent photographs of the solar surface on a large scale. Using the astrographic telescope at Poulkowa, which gives a solar image 8 cm. diam., this is enlarged by means of a concave magnifier to 54 cm. (21·3 in.). During May and June, 1905, numerous photographs were thus obtained, showing many of the finer details of the granulations which cover the solar surface. Numerous improvements were gradually introduced, chiefly with respect to the intervals between successive photographs, so that it became possible to obtain 8 consecutive plates with intervals of only 15 to 30 seconds' duration. Many of these show the changes in the sizes and grouping of the granules very clearly, and some are reproduced in the paper. For following the movements of any single particle it was found necessary to enlarge still further, and the pictures showing the wanderings of the granules are on a scale of 6 m. (19·7 ft.) to the solar diameter. The velocity of the granules varied from 14 to 30 km. per sec. and their diameters from 670 to 2,000 km. C. P. B.

1197. *Orbital Planes of Jupiter's Satellites.* **W. de Sitter.** (Konink. Akad. Wetensch. Amsterdam, Versl. 14. pp. 787–799, April 11, 1906. Proc. 8. pp. 767–780, April 24, 1906.)—The material for this investigation was provided by the series of heliometer observations and photographs taken at the Cape of Good Hope Observatory at various times since 1891. Eclipse observations are not well adapted for the determination of the inclination and nodes, which must be determined from the observed latitudes. The principal interest of the determination of the orbital planes lies in the comparison with the observations of the large motions of the nodes. Since these motions are produced almost exclusively by the large polar compression of the planet, the natural fundamental plane to which the latitudes must be referred is the equator of Jupiter. Results of the investigation are given in a series of tables for each of the satellites separately for the years 1891, 1901, 1902, 1903, 1904. C. P. B.

1198. *Stereoscopic Determination of Stellar Proper Motions.* **Lœwy.** (Comptes Rendus, 142. pp. 1007–1008, May 7, 1906.)—Lœwy describes the new method adopted by Max Wolf at Heidelberg for determining stellar proper motions. Two photographs are obtained of a certain group of stars with the same instrument at intervals of several years, and then placed in a stereoscope. In the case of one star four years' interval proved sufficient to show its varied position with respect to its neighbouring stars. The movement will probably be determined by this method more accurately than by ordinary micrometric measures. C. P. B.

REFERENCES.

1199. *Comparison of Aneroid Barographs.* **E. Rosenthal.** (Acad. Sci. St. Pétersbourg, Bull. 19. pp. 115–170, Oct., 1903.)—Comparisons of working of aneroid and mercury barographs for calibration. C. P. B.

1200. *Case of Failure of Iron from Fatigue.* **W. H. Finley.** (Eng. News, 55. p. 487, May 3, 1906. From Transactions of the Eng. Assoc. of the South, 1905.)—Failures of coupling pins of a mine trip having twice occurred with serious consequences, the author found a piece of one of them which showed a crystalline fracture. Several pins were then found to be so brittle that they could be broken by a sledge-hammer, but toughness were restored to all by annealing ; therefore the practice of annealing the pins every 6 months was adopted. It is stated that the "crystallisation" was due to fatigue, but there is no evidence for this view. F. R.

1201. *Season-cracking of Brass and Bronze Tubing.* **E. S. Sperry.** (Mech. Eng. 17. pp. 325–326, March 10, 1906. From The Brass World.)—Several instances are given of tubes in which cracks have developed some months after drawing. Chemical analysis shows that the fault could not be traced to composition. All tubes showing spontaneous cracks met with by the author were drawn on hydraulic benches. He thinks that undue advantage is taken of the greater pull available by hydraulic as compared with chain benches, the tubes being reduced too much at each draw. The cause is considered to be that overstrained brass tends to recrystallise. F. R.

1202. *Collision with and without Friction.* **R. H. Smith.** (Engineer, 101. pp. 187–188, Feb. 23 ; 237–238, March 9 ; and pp. 287–288, March 23, 1906.)—The point specially important in engineering in regard to collision is the circumstances of maximum strain, and this is not the point usually considered in text-books. The general problem of oblique and excentric collision is here discussed on certain assumptions, friction being taken into account, but the strains within the colliding bodies being neglected except as giving the formula $(V - v)\sqrt{[EMm/(M + m)]}$ for the maximum pressure at closest contact on direct collision. R. E. B.

1203. *Theory of Friction.* **V. Fischer.** (Phys. Zeitschr. 7. pp. 425–428, June 15, 1906.)—The dependence of friction on the relative velocity of the rubbing bodies when unlubricated is deduced from the principle of energy [but by a doubtful process]. It is thence concluded that at the actual start of the relative motion there is no friction whatever, and that the motion begins by a shift of the outer layers of the bodies over their inner layers. For shafts in lubricated bearings the dependence of the heating on the sizes of the shaft and bearing and on the speed of rotation is determined on certain assumptions. R. E. B.

1204. *Acceleration of Spherical Waves of Shock.* **Jouguet.** (Comptes Rendus, 142. pp. 1034–1036, May 7, 1906.)—The method of a former paper [Abstract No. 863 (1906)] is here applied to spherical waves, and it is shown that they are accelerated or retarded according as $\partial\rho/\partial t$ (where ρ is the density at time t at a point behind the wave-front at distance x from the centre of the disturbance) is greater or less than a certain amount which is expressible only by a differential equation. These waves differ from plane ones in that their speed of propagation depends on the way in which the gas expands behind the wave-front, and it seems probable that there is no explosive wave properly so called that is spherical and moves with a constant speed independent of its mode of generation. R. E. B.

1205. *Relative Motion and Foucault's Pendulum Experiment.* **L. Tesař.** (Ann. d. Physik, 19. 3. pp. 613–632, March 2, 1906.)—A thorough and destructive criticism of Denizot's conclusions [see Abstracts Nos. 924 and 1685 (1905)]. **A. Denizot.** (Phys. Zeitschr. 7. pp. 507–510, July 15, 1906.) R. E. B.

1206. *Statistics of Non-perturbated Systems.* **L. Silberstein.** (N. Cimento, 11. pp. 21–34, Jan. and Feb., 1906.)—A mathematical paper in which certain problems in mechanics are treated by the method adopted by J. W. Gibbs in his "Elementary Principles in Statistical Mechanics." S. G. S.

1207. *Equilibrium of an Elastic Solid in the Cyclic Form.* **V. Volterra.** (N. Cimento, 10. pp. 361–385, Dec., 1905; and 11. pp. 5–20, Jan. and Feb., 1906.)—Weingarten has shown that a solid may be in equilibrium when not subject to external force or force of mass, although the material is not in its natural condition, but in a state of tension. In the present paper the author shows that this is the condition which holds when the body is cyclic. The paper is entirely mathematical, and the case of an elastic solid occupying a cyclic space and undergoing regular deformation is discussed. The displacement at every point can be calculated from the force of mass, the external force and the forces at the planes of section required to render the space acyclic, and is no longer single valued. In the second paper the case of a symmetrical solid is considered. S. G. S.

1208. *Rainfall at Rome.* **F. Eredia.** (Accad. Lincei, Atti, 15. pp. 450–456, April 22, 1906.)—From records of rainfall taken since 1825, the author has shown by tabulating the excess over the amount which is proportional to the length of the month, that by far the greatest rainfall occurs in September, October, November, December, and January. May, June, July, and August have much less than their proportionate amount, and the greatest variations occur in October, November, and December, the months of greatest average rainfall. S. G. S.

1209. *Cyclonic Storm of Oct.* 6–12, 1905, *in the North Atlantic.* **J. Page.** (Monthly Weather Rev. 34. pp. 1–7, Jan., 1906.)—The storm advanced from the Caribbean Sea to the vicinity of Newfoundland. At the centre of the depression the barometer went down to 709 mm.; the diameter of the hurricane exceeded in the later days 600 miles, and shipping suffered severely. The storm was first reported from the sea south of Porto Rico; it devastated Haiti on the next day, and travelled out to the Atlantic. The author traces the records and gives synoptic charts. H. B.

1210. *The Vesuvius Eruption and Dry Fog at Paris, April* 11, 1906. **S. Meunier.** (Comptes Rendus, 142. p. 938, April 17. 1906.)—A dry yellow fog was hanging over Paris in the morning of April 11. The author collected on plates, covered with glycerine, some very fine sand, strongly resembling Vesuvius ashes ejected in 1822, which he has in his possession. H. B.

1211. *Action of Jupiter in Formation of Simple Meteoric Radiants.* **T. Brédikhine.** (Acad. Sci. St. Pétersbourg, Bull. 17. pp. 167–188, Dec., 1902.)—The author has previously endeavoured to show that the primary origin of meteorites may be in great part attributed to nuclear emissions excited by solar radiation [see Abstract No. 976 (1903)]. The present note is devoted to an examination of the conditions governing the formation of simple radiants, with special attention to those coming under the action of the planet Jupiter; the action is measured by determining the displacements of the nodes of the orbit of the various swarms at each apparition. C. P. B.

1212. *Solar Envelopes at Epoch of Minimum,* 1900. **M. N. Donitch.** (Acad. Sci. St. Pétersbourg, Bull. 18. pp. 95–111, March, 1903.)—The various photographs of the sun's chromosphere and corona obtained in Spain and Sumatra during the total eclipse of May 28, 1900, have been minutely examined to determine the relative depths of the chromospheric layers giving characteristic spectra. The author concludes that from D to K the spectrum of the chromosphere does not show any sensible variation from one eclipse to another, but that the corona spectrum does appear to vary with the solar period. C. P. B.

1213. *Studies of Solar Chromosphere without Eclipse.* **M. N. Donitch.** (Acad. Sci. St. Pétersbourg, Bull. 19. pp. 171–186, Oct.; and pp. 195–207, Nov. and Dec., 1903.)—Photographs of the chromosphere were taken with a powerful spectrograph furnished with a semicircular slit, permitting the simultaneous examination of 180° of the sun's limb at one operation. The heights of the layers in bright lines due to various radiations were determined from the lengths of their corresponding chords. [See Abstracts Nos. 974, 975 (1903).] C. P. B.

1214. *Repulsive Force of the Sun.* **T. Brédikhine.** (Acad. Sci. St. Pétersbourg, Bull. 20. pp. 39–48, Jan., 1904.)—Discussion of various calculated values of the sun's repulsive force, as measured from the directions of the tails of comets. C. P. B.

1215. *Explanation of Comet Forms.* **R. Jaegermann.** (Acad. Sci. St. Pétersbourg, Bull. 19. pp. 209–220, Nov. and Dec., 1903.)—Discussion of various determinations of cometary composition and corresponding theories as to their production. C. P. B.

1216. *Height of Aurora Borealis.* **V. Kousnetzow.** (Acad. Sci. St. Pétersbourg, Bull. 21. pp. 141–149, Sept., 1904.)—Observations of the varying heights of the aurora at the Constantin Observatory, Pavlovsk, from 1878 Jan. 1–1904 Jan. 1, with corresponding determinations at various stations from 15–63 km. distance. Results not yet stated. C. P. B.

1217. *Comet Borelly,* 1903 *IV.* **R. Jaegermann.** (Acad. Sci. St. Pétersbourg, Mém. 16. 12. pp. 1–42, 1905.)—Analytical discussion of the orbit, and the motion of the matter composing the multiple tails. C. P. B.

1218. *Temperature and Pressure Variations.* **W. J. S. Lockyer.** (Nature, 73. pp. 594–595, April 19, 1906.)—This is mainly a review of a paper by Rijckevorsel on the mean annual temperature variations for 22 stations. From the discussion of these it appears that there is evidence of a half-yearly period of temperature during twelve months, the epochs of which are identical over the whole of the earth's surface, with maxima at the beginning of March and September, and two minima on the first days of June and December. The barometric variations reviewed are those in an article by Krebs, who discusses the distribution of the short-period pressure variations first announced by N. Lockyer and the author, and constructs an isophase map which is not satisfactory. C. P. B.

1219. *Great Photographic Nebula near* π and δ Scorpii. **E. E. Barnard.** (Astrophys. Journ. 23. pp. 144–147, March, 1906.)

1220. *Hamburg Observatory Eclipse Expedition, Aug.* 30, 1905. **A. Schwassmann.** (Zeitschr. Instrumentenk., Beib. 5. pp. 43–45, March 1, 1906. Paper read before the Zweigverein Hamburg-Altona der D.G.f.M.u.O., Dec. 12, 1905.)—Account of instruments used at station Souk-Ahras by the staff of the Hamburg Observatory. (Nature, 73. pp. 537–538, April 5, 1906. From Mittheil. der Hamburger Sternwarte, No. 10. Abstract by **W. J. S. Lockyer.**)—Excellent photographs obtained with large scale coronagraphs, showing the disturbed vortex-like areas in the corona which have been noted by other observers [see Abstracts Nos. 486, 487, 488 (1906)]. C. P. B.

1221. *Spectrum of Nova Aquilæ No.* 2. **J. H. Moore.** (Astrophys. Journ. 23. pp. 261–263, April, 1906.)—Observations were made at the Lick Observatory on Sept. 5, 1905, with a single-prism spectroscope, the magnitude of the Nova being about 10·5. The spectrum was then similar to that of Nova Geminorum as seen on April 1, 1903, consisting of a number of bands, the brightest of which was identified as H_β. Three photographs of the spectrum were obtained on Sept. 6, 10, and Oct. 11. On the photographs several variations of intensity are noted with respect to the lines in Nova Geminorum [see Abstracts Nos. 240, 241 (1904)]. C. P. B.

LIGHT.

1222. *Improved Apparatus for measuring Magnetic Rotations and obtaining a Sodium Light.* **W. H. Perkin, sen.** (Chem. Soc., Journ. 89. pp. 608–618, April, 1906.)—To secure the advantages of both systems in vogue for obtaining the magnetic field necessary for experiments on magnetic rotations, the author has devised an arrangement in which a short but very powerful ironclad electromagnet is employed. The core has a 3-in. gun-metal tube through the centre, in which the glass measuring-tubes are supported by a metal trough which can be kept at any desired temperature. To avoid the disadvantages (specially felt in measuring large rotations) arising from the use of a sodium flame not strictly monochromatic, a direct-vision prism attached to the eyepiece or placed in the telescope of the analyser is employed; through this a distinct image of the half-shadow disc is observed; this disc is on the analyser in the apparatus used; the prismatic colours arising from the impurity of the sodium flame are seen on either side of the image. A powerful sodium light is obtained by employing a large Bunsen burner with a fine-bore central tube fed with oxygen. The burner is placed under a platinum boat containing sodium chloride, which is thus kept semi-fused; the internal flame produced by the oxygen passing up the small tube impinges on the side of the boat near the bottom; the sodium chloride is thus caused to volatilise, and at the same time the part of the flame passing up the side carries the sodium chloride vapour with it and produces a very intense and well-sustained sodium light. D. H. J.

1223. *Spectroscope with Variable Dispersion.* **P. Krüss.** (Zeitschr. Instrumentenk. 26. pp. 139–142, May, 1906. Communication from the Optical Inst. of A. Krüss, Hamburg.)—This is a small direct-vision spectroscope with collimator and telescope in one tube, which can be clamped to a stand and is designed for the use of analysts in the dyeing industry. The dispersion is varied by means of a device which Abbe employed as compensator for his refractometer. There are two prisms exactly alike, one placed directly behind the other, which can be rotated about the common optic axis through equal angles in opposite directions by means of a pinion and double rack arrangement, the pinion being turned by a head outside the tube. If D be the dispersion due to either prism separately, the total dispersion will vary from 0 when the refracting edges of the prisms are in opposite directions perpendicular to the slit, to 2D when the refracting edges are in the same direction parallel to the slit. If the prisms be each rotated through an angle ϕ from the former or zero position, and b be the breadth of an absorption band given by a single prism, the breadth of the band in the resulting spectrum will be $2b \sin \phi$. A divided circle is provided for reading the angle of rotation. A. E.

1224. *Applications of the Entoptiscope.* **W. F. Barrett.** (Roy. Dublin Soc., Proc. 11. 8. pp. 62–88, May, 1906.)—The entoptiscope consists of two brass pillars supporting a head-rest and an eyepiece provided with a revolving diaphragm in which are pinhole apertures varying from 0·1 to 2·5 mm. diam. and one pair of pinholes each 0·1 mm. diam. Below the eyepiece is a transparent scale divided into fractions of 1 mm.; the shadow of this scale falls upon the eye of the observer and is thence projected much magnified upon the ground-glass stage below, along with the shadows of any opacities seen in the eye. At the base of the instrument is a concave mirror, which can be adjusted so as to illuminate the eyepiece brilliantly. The observer traces on the ground-glass with a pencil the image of the opacities in the eye. During the observation the eye not under examination is covered. In a later and improved pattern there are two cupped eyepieces which are mounted on a single brass pillar, and a special contrivance is provided for the exact centering of the pinhole apertures. The ground-glass plate can be replaced by plain glass, and tracings made on specially prepared paper ruled in 5 mm. squares for convenience in measuring. To save calculation the distance from the glass stage to the pinhole aperture can be made either 5 or 10 times the distance of the aperture from the pupil. The exact area of the obscurity is therefore 25 or 100 times less than the area of the image drawn by the patient. [See Abstract No. 882 (1906).] The author describes in detail the various phenomena which can be observed with the instrument.

H. W. P. Y.

1225. *Interference Bands produced by a Grating placed near a Thin Plate.* **G. Meslin.** (Comptes Rendus, 142. pp. 1039–1042, May 7, 1906.)—If a grating is put on or near the convex surface of a very slightly curved lens, large rings are seen which differ from the Newton's rings given by the lens in several respects; thus they are larger and more widely separated, they are visible in white light even if the grating is separated from the lens by a few mm., they are but little coloured and are even sensibly achromatic for incidences of about 45°, and their diameters decrease as the incidence increases. The explanation given is that interference occurs between two sets of rays which emerge from the lens in parallel directions, the one set being first diffracted by the grating and then, passing into the lens, being reflected at the further surface, the other set being first reflected at the further surface of the lens and then diffracted on emergence. It is stated that the observation of these bands is a very valuable test of progress in the working of plane surfaces, monochromatic light not being needed; it can further be employed to follow with much precision the displacements and deformations of such a surface as that of mercury.

R. E. B.

1226. *Red-Sensitiveness of Dyed Films.* **W. A. Scoble.** (Photographic Journ. 46. pp. 190–195; Discussion and correspondence, pp. 195–197, May, 1906.)—The prismatic and diffraction spectra of a 100-volt Nernst lamp are photographed from yellow to red on films exposed wet, soon after being dyed, and curves are sketched representing the estimated intensity of the developed image over its range. The best dyes thus found are alizarine blue, pinacyanol and dicyanin in order of excellence; plates dyed with alizarine blue gave records up to λ8,750, those with pinacyanol to λ7,720. Alizarine blue, although much the cheaper dye, is uncertain in its action. In the *discussion*, **Waterhouse** confirmed the statement regarding the uncertain action of the last-named dye.

G. E. A.

1227. *New Type of Biaxial Crystal.* **E. Sommerfeldt.** (Phys. Zeitschr. 7. pp. 207–208, March, 15, 1906.)—An organic substance (a condensation product of mesityl oxide-methyl oxalate) recently prepared in the chemical laboratory of Federlin, in Tübingen, shows remarkable properties when viewed in converging polarised light between crossed nicols. It is found that the plane of the optic axes lies parallel to the plane of symmetry. Also when viewed by sodium light the interference phenomena do not, as with ordinary biaxal crystals, give two intersecting dark bands, but only one such band, the other having disappeared. [See also Abstract No. 818 (1906).] E. H. B.

1228. *Light Generation and Light Absorption.* **A. Einstein.** (Ann. d. Physik, 20. 1. pp. 199–206, May 11, 1906.)—The author previously obtained, on Maxwell's theory in conjunction with the electron theory, results which are not in accord with experiments on the radiation from black bodies. [See Abstract No. 1562 (1905).] Planck's theory of radiation [Abstract No. 1284 (1901)] was then and is now again used. The subject is then mathematically treated, and a result obtained whose qualitative meaning may be thus stated: The more electropositive a metal, the smaller is the lowest effective light-frequency for the metal in question. It remains to be ascertained by experiment whether the formula is quantitatively exact. E. H. B.

1229. *Optical Rotation.* **H. M. Reese.** (Phys. Rev. 22. pp. 265–278, May, 1906.)—The diffraction-pattern is investigated which is produced by a rectangular opening through which passes a beam of light such that the amplitude is constant over the wave-front, but the azimuth of the plane of polarisation varies continuously and regularly from one side of the opening to the other. These conditions are approximately fulfilled when a beam of parallel rays, originally plane-polarised, is sent through a quartz prism which rotates the plane of polarisation. It is found that, in all cases where the change of azimuth na across the opening of breadth a exceeds π, the intensity at the middle of the field is zero or very small, that a large maximum occurs where $\sin\theta = \pm n\lambda/2\pi$ or thereabouts, and that there are several small maxima. The general effect therefore is to produce a double line in the focal plane. It furthermore appears that the difference in phase of two mutually perpendicular components of the vibrations is $\pi/2$ for one of these lines and $-\pi/2$ for the other, so that they correspond to directions along which the transmitted light is circularly polarised in opposite senses. An explanation of the phenomenon observed by Fresnel is thus arrived at without any assumption as to the velocity of circularly polarised light in the prism. It is, however, shown that the mere fact of rotation is a proof that the apparent velocities of right-handed and left-handed circularly polarised light are different in the rotating medium, so that the explanation here given and that of Fresnel are equivalent. The difference of velocities applies only to velocities measured by interference methods: the group-velocity, or the velocity of the front of a train of waves, is independent of the polarisation. R. E. B.

1230. *Magnetic Rotatory Polarisation.* **J. Becquerel.** (Comptes Rendus, 142. pp. 1144–1146, May 21, 1906.)—A paper on the correlation between the variation of absorption bands in crystals in a magnetic field and magnetic rotatory polarisation. In crystals of xenotime, the absorption bands behave as if they were produced, some by the vibrations of negative electrons and others by the vibrations of positive electrons. A beam of plane-polarised white light is caused to fall on a plate of xenotime cut normal to the axis, and the absorption spectrum is obtained with a Rowland grating spectroscope. A rhomb of spar placed in front of the slit gives, in the eyepiece, two contiguous strips polarised in different planes but having the same intensity for a given position of the polariser. On generating a magnetic field parallel to the incident beam, the bands of the ordinary absorption spectrum change in intensity. In one of the strips, all of the bands corresponding to the negative electrons increase in intensity and contract slightly; the bands corresponding to the positive electrons become dimmer and spread. The effect corresponds to a negative rotatory polarisation of the unabsorbed part of the radiation in the negative electron bands and positive rotation in the positive electron bands. Anomalous dispersion of the bands and a case of circular magnetic double refraction are also described. [See also Abstracts Nos. 886 and 1056 (1906).] G. E. A.

1231. *Band Spectra.* **J. Stark.** (Phys. Zeitschr. 7. pp. 355–361, May 15, 1906.)—Two experiments are described, to show that the emitters of the band spectra are electrically neutral bodies. In the first the discharge between mercury electrodes is produced in an inverted U-tube; under normal conditions the greenish light which gives the band spectrum is noticed coming from the negative glow. If now the mercury acting as kathode be heated so that the mercury distils away from it, the emitters are driven away from the kathode by the vapour stream; if the other limb be heated so that the vapour stream is towards the kathode the emitters of the greenish light are found in the kathode dark space. In the next case it is found that the first kathode layer emits the band spectrum; hence, if the emitters possessed a positive charge they would be driven through the apertures in the kathode and exhibit the Doppler-effect, as do the canal rays; but this is not the case. On the other hand, if they possessed a negative charge they would be driven into the dark space and would there produce emission of light. Thus they have no charge. The author considers that the negative electron and the positive ion ("Restatom"), in the act of combining, emit the band spectrum, and that the different parts of the spectrum correspond to different phases of the act of combination. The energy available is therefore entirely potential, and is due to the separation of the opposite charges, and is therefore limited in amount. Thus, if the band is broadened through rise of temperature or pressure, the displaced part increases in intensity at the expense of the original part, and the band is always blurred when broadening occurs. In the case of the line spectrum the emitter is the positive ion, and the intensity of emission is proportional to the square of the velocity of translation [see Abstract No. 1055 (1906)], and thus along with broadening, the original line increases rapidly in intensity and consequently does not lose in definition. This distinction between the two kinds of spectrum is shown very clearly by spectra reproduced in the paper, which show the widening and consequent blurring of the band spectra of hydrogen and nitrogen as the pressure and temperature are increased. The last section of the paper deals with fluorescence. If the absorbed radiation produces a more or less stable modification of the atom, or produces complete separation into its parts, the return to the original condition will take place slowly, and the process comes under the heading of phosphorescence, but when a change in configuration is produced without any actual separation, the return to the original state is exceedingly rapid, and the process is an example of fluorescence. S. G. S.

1232. *Optical Effects of the Translation of Matter through Ether.* **J. Stark.** (Phys. Zeitschr. 7. pp. 353–355, May 15, 1906.)—It has been shown by the author [see Abstract No. 885 (1906)] that the electrical vibrations of the light emitted by the canal rays are more intense when in the direction of translation of the rays than when at right angles to this direction, and the frequence in this direction is more affected by the motion of the emitter through the ether than the frequence of the vibrations normal to this direction. Also it has been shown by N. Egoroff and N. Georgiewski [see Phys. Soc. Abstracts Nos. 382 and 461 (1897)] that in the case of a magnetic field the intensity of vibration for certain lines is greater in a direction normal to a magnetic field than parallel to it. Combining the two effects, the author concludes that in a magnetic field the ether is in motion in a direction normal to the field. For the emission, on account of the relative motion of emitter and the ether, is proportional to the square of the difference of the proper velocity of translation (temperature) and the motion of the ether (magnetic field), and this will be greater in a direction normal to the field than parallel to it. [See also Abstract No. 889 (1906)]. S. G. S.

1233. *Effect of Calcium in Developing the Phosphorescence of Rare Earths.* **W. Crookes.** (Chem. News, 93. pp. 143–144, March 30, 1906.)—On several occasions objections have been taken to the author's view that the phosphorescence of the rare earths is sometimes intensified by mixing with calcium compounds, the effect being supposed to be due to impurities in the calcium compounds. The author gives references to the publications containing the results of the observations on which his view is based. He has shown that the character of the spectrum produced by a given earth varies considerably with the compound employed, the oxides generally giving "sharp line-spectra," and the sulphates, phosphates, &c., more or less nebulous, shaded bands. Urbain [Abstract No. 319 (1906)] has expressed the opinion that the band spectrum in the ultra-violet, ascribed by the author to an element 'victorium," is in reality due to gadolinium. New investigations show that the view that victorium is gadolinium plus an exciting agent is improbable, since by no mixing with calcium does pure gadolinium yield such strong victorium bands as the author's original preparation. Further the victorium-calcium bands are different in character and wave-length from those of victorium. T. H. P.

1234. *Secondary Röntgen Radiation.* **C. G. Barkla.** (Phil. Mag. 11. pp. 812–828, June, 1906. Communicated by the Physical Soc., Feb. 23, 1906.)—Experiments were made on the more penetrating radiations—those which had passed through several cm. of air and very thin aluminium leaf. Various gases and light substances (carbon, paper, wood, &c.), emit radiations closely resembling the primary, while from heavy substances—the metals Ca, Fe, Cu, Zn, Sn, Pt, and Pb—the radiations emitted have considerably less penetrating power than the primary producing them. It appears that the character of secondary radiation depends upon the atoms subject to the primary radiation and not on their distances apart or on their combination with atoms of other substances. The secondary radiation from substances of higher atomic weight was found to consist of a completely transformed radiation, purely scattered radiation being absent. There was no appreciable connection between the character of the radiation and the temperature, conductivity, or magnetic permeability of the radiating substance. No evidence of selective absorption was obtained. The radiation from tin was not specially absorbed by tin. The character of the secondary radiation from calcium did not depend to any appreciable extent on the intensity of the primary. It was found that as the difference in character between the secondary and primary rays became more marked by increasing the atomic weight of the radiator, the effect on the secondary of a change in character of the primary diminished. Differences in absorption observed may be due in some cases to the effect of heterogeneity in both primary and secondary beams, but experiment indicates that at least some substances emit a radiation differing considerably in absorbability from the primary, and exhibiting considerable variation in character as the primary is varied. From those substances in which, during the passage of a Röntgen pulse, the electrons are accelerated in the direction of electric displacement, the secondary radiation differs in intensity in different directions, giving evidence of the polarisation in the primary beam. These substances are also the origin of polarised secondary radiation. When the acceleration of electrons ceases to be in the same direction as the electric displacement in the primary pulse, evidence of polarisation of the primary disappears and the secondary radiation ceases to be polarised. On investigating the nature of the secondary pulses by the polarisation effects it was found that the character of the pulses changed, not abruptly with an increase in atomic weight, but very rapidly between certain atomic weights. The polarisation effect disappears with the similarity between the secondary and primary radiations. Thus the change in absorbability of the secondary radiation is accompanied by an acceleration of electrons in directions which are not those of electric displacement in the pulses producing the radiation. Change in character is accompanied by a change in the pulse structure. Curves showing a rise and fall in the absorption of the secondary radiation connect the absorption and atomic weights of elements in the first and part of the second long chemical periods, and the latter part of such a curve has been obtained with the latter part of the third long period. The theory applied to the secondary radiation from certain gases and light solids may be extended to explain the results of experiments on metals. In light atoms the electrons have sufficient freedom to move independently, and thus to emit a radiation whose penetrating power is the same as that of the primary, and whose intensity depends on the direction of propagation with regard to the plane of polarisation in the primary beam. In heavier atoms each electron is more intimately connected with neighbouring electrons, and therefore subject to disturbing forces for a period which is much greater than that of the passage of the primary pulse over it, hence the secondary pulse emitted is thicker and more complex in character, which produces greater absorbability. The interference with the simple direct acceleration due to the primary pulse prevents pure scattering and accounts for the disappearance of polarisation in the secondary beam and of evidence of polarisation in the primary. An increase in thickness of the primary pulse produces an increase in thickness of the secondary pulses, consequently an increase in absorbability of the primary results in an increase in the absorbability of the secondary. On this hypothesis the penetrating power of the secondary radiation is a measure of the independence of motion of electrons within the atom; and the relation between absorption and atomic weight exhibiting a periodicity which is obviously connected with the periodicity in chemical properties, is evidence of a connection between chemical properties and distribution of electrons in the atom, such as is suggested by J. J. Thomson. [See also Abstracts Nos. 1400 (1905) and 712 (1906).] J. J. S.

1235. *Radium in the Earth's Crust.* **R. J. Strutt.** (Roy. Soc., Proc. Ser. A. 77. pp. 472–485, May 14, 1906. Chem. News, 93. pp. 235–237, May 25, and pp. 247–249, June 1, 1906.)—An investigation was made of the amount of radium in various representative rocks. The radium was quantitatively determined by means of its emanation. A measure of the amount of radium present was obtained by observing the increased rate of leak in an electroscope, and this measure was made absolute by going through the same process with a uranium mineral of known radium content. For surface rocks the experiments show that 5×10^{-12} gm. per c.cm. is a representative value for the amount of radium present. From calculations based on the thermal conductivity of the earth it would appear that the earth cannot contain on the average more than $1{\cdot}75 \times 10^{-13}$ gm. of radium per c.cm. Thus not more than about $\frac{1}{30}$ of the earth's volume can consist of material similar to that met with on the surface. This gives a depth of about 45 miles for the rocky crust, assuming the total absence of radio-active material within. The following are the conclusions reached by the author: (1) Radium can easily be detected in all igneous rocks. Granites, as a rule, contain most radium, basic rocks the least. (2) This distribution of radium is uniform enough to enable a fair estimate to be made of the total quantity in each mile of depth of the crust. (3) The result indicates that the crust cannot be much more than 45 miles deep, for otherwise the outflow of heat would be greater than is observed to be the case. The interior must consist of some totally different material. This agrees with Milne's conclusion drawn from a study of the velocity of propagation of earthquake shocks through the interior. (4) The moon probably consists for the most part of rock, and if so its internal temperature must be far greater than that of the earth. This explains the greater development of volcanoes on the moon. (5) Iron meteorites contain little, if any, radium. Stony ones contain about as much as the terrestrial rocks which they resemble. [See also Abstract No. 305 (1906).] J. J. S.

1236. *Radiation of Polonium.* **B. Kučera** and **B. Mašek.** (Phys. Zeitschr. 7. pp. 337–340, May 15, 1906. Extract from Berichte der böhm. Kaiser Franz-Joseph-Akad. d. Wiss. in Prag.)—The authors confirm the identity of the *α*-rays of radium with polonium rays by an investigation of the connection between the distance of the preparation and the ionisation of the surrounding gas, as well as the change of the effect with age. The rate of decrease of ionisation with increasing thickness of air is the same in the case of the *α*-rays of radium, of radium emanation, of radium A, radium C, and polonium. This analogy is another proof that Rutherford's radium F is identical with polonium ("radiotellurium"). Age does not affect the characteristic shape of the curve. After two years the ordinates are reduced to one-eighteenth. With an atmospheric pressure of 733 mm. the "range" of a polonium particle is about 4·1 cm. E. E. F.

1237. *The α-rays from Radio-thorium.* **O. Hahn.** (Phil. Mag. 11. pp. 793–805, June, 1906. Phys. Zeitschr. 7. pp. 412–419, June 15, 1906.)—In this paper an account is given of investigations on the following points in connection with radio-thorium [see Abstract No. 2189 (1905)]: (1) Range of the *α*-particles in air from the active deposit of radio-thorium by the method of scintillations and by the electrical method of Bragg and Kleeman. The maximum range at which scintillations were visible was found to be 8·3 cm. In agreement with this is the observation by the method developed by Bragg and Kleeman, which indicates that the ionisation of the *α*-rays begins at a distance of 8·6 cm. from the source. (2) It is shown that the product called thorium B is complex, and consists of two distinct α-ray products which have different ranges of ionisation in air. (3) A preliminary investigation was made of the magnetic and electrostatic deflection of the α-particles from the active deposit. The rays were deflected both by a magnetic and electric field, and to about the same extent as the rays from radium C. J. J. S.

1238. *α-Particles of Uranium and Thorium.* **W. H. Bragg.** (Phil. Mag. 11. pp. 754–768, June, 1906.)—The range of the α-particles is investigated. The method already used for those from radium is not workable on account of the smallness of the ionisation: a new method is therefore devised, the theory of which is given in the first part of the paper. The ionisation due to a radio-active layer is calculated, the substance being covered by a screen. This is found to be a function of the stopping power of the screen and the range of the particle. The ionisation and stopping power can be determined experimentally, and hence the range deduced. For the somewhat complicated formula obtained the paper must be consulted. In practice the results for uranium and thorium are compared with those for radium; the general conclusion is that Ur, Th, Ra, emit α-particles of nearly, if not exactly, the same speed. It is also found that uranium atoms break down very nearly five times as fast as thorium. R. S. W.

1239. *Danger of Explosion with Radium.* **P. L. Mercanton.** (Phys. Zeitschr. 7. pp. 372–373, June 1, 1906. Phys. Inst. München, March, 1906.)—A tube containing 15 mgm. of pure radium bromide (Giesel), closed since the beginning of December 1902, was subjected to test, so that if a gas were present under pressure the gas could be spectroscopically examined and its pressure measured. The radium tube was locally warmed by an electrically heated spiral in a combustion chamber connected to a manometer and a vacuum tube. On heating the end of the tube without making any perceptible opening, the only change noticed was that a protecting grid of brass wire placed within the combustion tube had become strongly radio-active. The end of the tube was melted in a flame, the tube heated for an hour at 150°, and replaced within a similar apparatus, and the glass softened at a different place. No induced radio-activity was noticed this time, and it is concluded that radium emanation does not diffuse through glass softened by heat, also that the pressure in the radium tube after being closed for 38½ months was less than atmospheric. [Compare Dorn, Abstract No. 1121 (1904).] G. E. A.

1240. *Ionisation produced by α-Rays.* **H. L. Bronson.** (Phil. Mag. 11. pp. 806–812, June, 1906.)—This paper consists of two parts: (1) An account is given of an investigation as to how the ionisation produced by an α-particle varies near the end of its path. It was found that the number of ions per cm. produced by the α-particle increases over the first 6·4 cm. of its path, and then decreases very rapidly, falling to less than 0·5 per cent. of the total at 7·1 cm. There was no evidence that the α-particle continued to produce ions beyond about 7·5 cm. It appears likely that the α-particle loses its energy very rapidly near the end of its path by collision with the gas molecules, and is completely absorbed by a thickness of air of 7·2 cm. (2) The result is given of an investigation to determine whether radium B emits α-rays or not. It appears that radium B does not give off α-particles, or at any rate none of sufficient velocity to ionise air. J. J. S.

REFERENCES.

1241. *Preparation of Spectrographic Objectives.* **J. Wilsing.** (Zeitschr. Instrumentenk. 26. pp. 101–107, April, 1906.)—Analytical study of chief points to be considered in the design of objectives for spectroscopic purposes, with tables showing various foci of lenses of different types for standard wave-lengths. [See Abstracts Nos. 1013 (1900) and 86 (1905).] C. P. B.

1242. *Determination of the Feldspars by means of their Refractive Indices.* **F. E. Wright.** (Amer. Journ. Sci. 21. pp. 361–363, May, 1906.)—The principle of the first method given in a former paper [see Abstract No. 1919 (1904)] is used to distinguish the feldspars, seven mixtures of cedar, clove, and cinnamon oils being made with the same refractive indices for yellow light as the seven feldspars. A particle of the mineral when immersed in a mixture of the same index shows red and blue edges with oblique ordinary light. G. E. A.

1243. *Method of calculating the Times of Development at various Temperatures.* **W. B. Ferguson.** (Photographic Journ. 46. pp. 182–188; Discussion, pp. 188–189, May, 1906.)—From observations previously made [see Abstract No. 999 (1905)] the velocity of development is expressed as an exponential function of the temperature, and examples are given of the use of the formula in calculating the time of development for a given temperature from standard determinations made at two temperatures. In the *discussion*, **S. E. Sheppard** did not consider that the formula would hold beyond the range of 10°. G. E. A.

1244. *So-called Internal Conical Refraction in Pleochroic Crystals.* **W. Voigt.** (Ann. d. Physik, 20. 1. pp. 108–126, May 11, 1906.)—A mathematical treatise, on the electromagnetic theory, of the so-called internal conical refraction in pleochroic crystals, showing that other phenomena are here to be expected which do not obtain in ordinary biaxal crystals. A full experimental confirmation is difficult, as the materials most suitable for the purpose are hard to obtain, but some experiments have been made showing a satisfactory agreement on the points they were designed to test. [See also Abstracts Nos. 211 (1903), 313, 902, and 1069 (1906).] E. H. B.

1245. *Structure of optically-active Monoclinic Hemihedral Crystals.* **E. Sommerfeldt.** (Phys. Zeitschr. 7. pp. 390–392, June 1, 1906.)—An elaborate discussion of the author's view-point of the matter in reply to W. Voigt [Abstract No. 1069 (1906).] E. H. B.

1246. *Relation between Absorption Spectra and Chemical Constitution.* IV. *Reactivity of the Substituted Quinones.* **A. W. Stewart** and **E. C. C. Baly.** (Chem. Soc., Journ. 89. pp. 618–631, April, 1906.)—The paper contains an account of the absorption spectra of the following quinones: *p*-benzoquinone, toluquinone, *p*-xyloquinone, thymoquinone, chlorobenzoquinone, bromobenzoquinone, 2:6-dichlorobenzoquinone, trichlorobenzoquinone, trichlorotoluquinone, and dichlor- and dibrom-thymoquinones. The facts give further support to the thesis that the best explanation is to be sought, not in the familiar idea of steric hindrance, but in the influence of the substituents on the isorropic process in which the quinone carbonyls are concerned. [See Abstract No. 1050 (1906).] D. H. J.

1247. *Need for a Radio-active Standard.* **C. E. S. Phillips.** (Roentgen Soc., Journ. 2. pp. 79–85; Discussion, pp. 85–90, 93–94, and 96–101, April, 1906.)—The utilisation of uranium or radium for the preparation of a standard is discussed, the author giving his reasons for preferring the latter, both for the absolute and for the commercial standard (some multiple of the former). In the *discussion*, a great difference of opinion was manifested, the chief point upon which unanimity existed being the desirability of utilising the ionisation property in defining the standard. L. H. W.

HEAT.

1248. *Voigt's Method of determining Heat-conductivity in Crystals.* **F. M. Jaeger.** (Konink. Akad. Wetensch. Amsterdam, Versl. 14. pp. 799–804, April 11, 1906. Proc. 8. pp. 793–797, May 25, 1906.)—When heat is communicated to a plate of a twin crystal at a point in the separation-line of the twin, the bounding isothermals on the two parts (made visible by the fusion of a mixture of elaidic acid and wax upon the plate) cut each other at an angle ϵ which is given by $(A-1)\cot\frac{1}{2}\epsilon = A\tan\phi + \cot\phi$, where A is the ratio of the greatest and least conductivities along the plate, and ϕ is the angle made by the direction of the greatest conductivity with the separation-line of the twin. Thus A is not determinate in general from a knowledge of ϵ only, but it is so if $\phi = \pi/4$ as assumed by Voigt, since then $A = \tan(\frac{1}{4}\pi + \frac{1}{2}\epsilon)$. If ϕ could be varied, then ϵ would be greatest and equal to $\pi - 4\phi$ when $\cot^2\phi = A$, and in this case $\sin\frac{1}{2}\epsilon = (A-1)/(A+1)$. It is concluded that when, as is usually the case, A is not much different from 1, we may take $\phi = \frac{\pi}{4}$ with fair accuracy [but this does not at all necessarily follow].

R. E. B.

1249. *Boiling-points of the Alkali Metals.* **O. Ruff** and **O. Johannsen.** (Ber. Deut. Chem. Gesell. 38. pp. 3601–3604, 1905.)—Determined in a wrought-iron distilling apparatus by means of a platinum—platino-rhodium thermo-element, under 760 mm. pressure, the boiling-points are as follows: Caesium, 670°; rubidium, 696°; potassium, 757·5°; sodium, 877·5° C. With lithium, at about 1,400°, half remained unchanged in the distillation apparatus, so that its boiling-point must be above this temperature. The boiling-points cannot be represented as a simple function of the atomic weights. W. H. SI.

1250. *Specific Heats of Chromium, Sulphur, Silicium, &c., at Low Temperatures.* **C. Forch** and **P. Nordmeyer.** (Ann. d. Physik, 20. 2. pp. 423–428, June 1, 1906.)—By Dewar's method [see Abstract No. 1757 (1905)], except that the mass and not the volume of liquid air vaporised was determined, the specific heats of certain metals and crystalline salts were determined between —190° and 14° C., the heat of vaporisation of liquid air being taken to be 50. The values found, multiplied by 1,000, are the following: Pb 30, Sn 53, Si 87, Cr 88, S 135, HgCl 41, $HgCl_2$ 60, $CuSO_4$ 201, $FeSO_4$ 239, K_2SO_4 143, $(NH_4)_2SO_4$ 233, $NaNO_3$ 184, NH_4NO_3 254, potassium oxalate 186, dextro tartaric acid 190. Comparison of these numbers, taken as the specific heats at —88°, with those that have been found for temperatures above 0° seems to show that at —273° the specific heat lies between 0·03 and 0·08 [but conclusions drawn from such rough extrapolation are valueless]: further, silicon shows the same kind of variation of its specific heat with temperature as carbon and boron.

R. E. B.

1251. *Study of the Bunsen Flame.* **W. Allner.** (Journ. f. Gasbeleucht. 48, pp. 1035–1041, Nov. 25; 1057–1066, Dec. 2; 1081–1086, Dec. 9; and pp. 1107–1112, Dec. 16, 1905. From Dissertation, Karlsruhe.)—An extension to mixtures of CO_2 and hydrogen, CO and hydrogen, methane and hydrogen, methane, hydrogen and CO_2, benzene and hydrogen, benzene, hydrogen and

CO_2, and pure benzene, of Haber and Richardt's method [see Abstract No. 815 (1904)] for calculating the temperature of the inner cone of a Bunsen flame from the composition of the products of combustion, by making use of the alteration of the constant K of the equilibrium $\frac{H_2O \, . \, CO}{CO_2 \, . \, H_2}$ with the temperature. The method gave satisfactory results in all cases, except with the two first-mentioned mixtures, with which it is probable that the temperatures produced are not sufficiently high for equilibrium to be attained in a short time. It was necessary with the benzene flame to withdraw the combustion gases from the lower portion of the flame, as with such a hot flame the equilibrium is displaced during the withdrawal of the gases through the cooling zone at the upper part of the inner flame. W. H. Si.

1252. *Measurement of Temperature by Electrical Means.* **E. F. Northrup.** (Amer. Inst. Elect. Engin., Proc. 25. pp. 219–250, May, 1906.)—Deals principally with the uses and methods of application of electrical resistance thermometers made of pure platinum and of nickel wire, and of thermocouples. The conditions to be satisfied by electrical means of measuring temperatures, and the manner in which these can be satisfied are described. Typical forms of resistance thermometers and of the resistance-measuring apparatus used in connection with them are described and illustrated, among the latter being an instrument which the author has designed and named the "Ratiometer." This consists essentially of a moving-coil galvanometer whose moving system carries two flat coils so arranged that a deflection of the system brings a larger portion of one coil under the pole-faces while a larger portion of the other coil is removed from under the pole-faces. When currents flow through both coils in such direction as to cause both coils to try to move away from the pole-faces, the system will seek a position of equilibrium which is independent of the actual value of the currents flowing and which depends only upon the ratio of the portions of the main current which divides to flow in the two coils. This requires that the spring control shall be negligible, and in the instrument as made this is the case. The deflections are magnified by means of a mirror and optical system attached to the case of the instrument. The Ratiometer may be used to measure the ratio of an unknown to a known resistance, or of a capacity-reactance to a resistance, or it may serve as a direct-reading deflection thermometer by measuring the ratio of a resistance which changes with the temperature to be measured, to a constant resistance. W. Ros.

1253. *Temperature of the Nernst Lamp.* **L. W. Hartman.** (Phys. Rev. 22. pp. 351–356, June, 1906.)—The temperature measurements are made with three thermo-junctions of different size; the thermo-e.m.f.'s were measured by potentiometer with the junctions in contact with the glowers, and the corresponding temperatures found from Kohlrausch's numbers. Means being taken to eliminate the effect of conduction in the thermo-elements, the values obtained from six different glowers gave results varying from 1,780° to 1,800° abs. Measurements made with a Wanner pyrometer gave values which were much too high; consequently the laws of Wien and Paschen do not apply to the Nernst glower. From a consideration of tables of the energy supplied to the glowers, it is shown that the economic superiority of the glower over that of a black body is not so great as has been claimed for it, the percentage loss by conduction, &c., in watts per cm. length being from 5 to 7 if the glower is assumed to follow the black-body law, and 70·5 if the temperature found by the thermo-element is taken as correct, and the energy is found which is required to heat a black body of the same dimensions as the glower to the same temperature. [See also Abstracts Nos. 1003 and 3217 (1904).] G. E. A.

1254. *Emissivity of Glowing Black Bodies and a Simple Pyrometer.* **W. Nernst.** (Phys. Zeitschr. 7. pp. 380-383, June 1, 1906. From the Phys.-chem. Inst. d. Univ., Berlin.)—The light from an electrically heated furnace (see Abstract No. 911 (1906)] is passed through a wide slit across which is placed a pencil made of a mixture of thorium oxide and spongy platinum, and rendered incandescent by a known current. The temperature of the furnace was measured by means of a Wanner pyrometer, and the pencil had been previously calibrated photometrically for various currents. Corresponding values of temperature and of emissivity, measured in Hefner candles per sq. mm. are obtained over a range of temperature from 1,449° to 2,290° abs. These values are used to determine the constants A and B of the equation: $\log K = -A/T + B$ [see Abstract No. 719 (1905)], K being the light emission in Hefner candles per sq. mm., and T the abs. temp. The numbers found are: $A = 11230$, $B = 5{\cdot}367$; the following table of values of K and T is also given:—

K	0·005	0·01	0·05	0·1	0·5	1	2	4	6	8	10	12	15	20
T	1464	1524	1685	1764	1982	2092	2217	2357	2246	2516	2571	2619	2680	2763

Incidentally the melting-point of iridium is stated as 2,348° C. from a measurement of its emissivity at the melting-point. The glowing rod in air, instead of a glow-lamp, is recommended as forming a simple and fairly accurate pyrometer. It is further suggested that the Hefner unit candle might be defined by determining the temperature at which the emissivity of the black body per sq. mm. is equal to unity, *e.g.*, 2,092° abs. according to the above table. For practical standards of light, besides ordinary glow-lamps, small 2-volt osmium lamps are recommended; supplied by a small accumulator and tested by means of a small cell-testing voltmeter, a very handy, portable standard could be made which would be independent of an electric installation, and would, besides, assist to generalise the use of the Hefner standard. G. E. A.

1255. *Air-liquefiers.* **F. G. Cottrell.** (Journ. Phys. Chem. 10. pp. 264–274, April, 1906.)—A Hampson liquefier is altered by the addition of an auxiliary coil, which is completely immersed in the liquefied air, so that the cooled air may issue either directly through the expansion valve or after further passage through the auxiliary coil, and it is found that the output is practically the same in both cases; hence the liquefaction does not seem to be the result of the Joule-Thomson effect. A thermodynamic discussion of the modified cycle follows, but present lack of data prevents definite conclusions being drawn. R. E. B.

1256. *Pre-cooling in the Liquefaction of Air.* **W. P. Bradley and G. P. O. Fenwick.** (Journ. Phys. Chem. 10. pp. 275–289, April, 1906.)—In continuance of a former paper [see Abstract No. 563 (1905)] the effects of external and internal pre-cooling were studied, the former occurring during the passage of the high-pressure air through the interchanger, and the latter by passage of the air through an extra coil cooled by liquid air in the reservoir. It was found that this internal precooling has no effect on the yield, the liquid air used for this purpose exactly replacing itself in whatever way it is used: the effect, however, of the external precooling on the yield is extraordinary, not only from a practical but also from a theoretical standpoint, being twice as great as would be expected from Schrötter's formula. It is difficult to see how these results are reconcilable (1) with each other, (2) with the view that the production of cold at the expansion-valve is due to the Joule-Thomson effect. Lastly, separation of the blast of mingled liquefied and unliquefied air at the valve into its constituents by a centrifugal device seems to increase the efficiency of the liquefier by 4 per cent. R. E. B.

1257. *Discontinuity of the Specific Heats at the Points of Saturation.* **E. H. Amagat.** (Comptes Rendus, 142. pp. 1120–1125, May 21, 1906.)—If the specific volume and specific heat (in dynamical measure) of a liquid when saturated at absolute temperature t and pressure f are u and m, the isometric specific heat of a saturated mixture of liquid and vapour of constant specific volume v is $m + t(d/dt)[(v-u)df/dt]$, which reduces to $m - t(du/dt)(df/dt)$ if no vapour is present. But the heat equation of a liquid is—

$$dH = cdt + t(\partial p/\partial t)dv$$

where c is its isometric specific heat, so that $m = c + t(du/dt)(\partial p/\partial t)_u$. Hence in crossing the saturation-curve from the liquid side the isometric specific heat *rises* discontinuously by the amount $t(du/dt)[(\partial p/\partial t)_u - df/dt]$; and in crossing the saturation-curve from the vapour side there is a similar discontinuous *rise* of the isometric specific heat by $t(du'/dt)[(\partial p'/\partial t)_{u'} - df/dt]$. [The author made slight slips in determining the signs of these changes.] These discontinuities are due to the assumed discontinuities of the isothermals where they meet the saturation-curve. Doubtless neither set of discontinuities really exists, but if sharp variation occurs between the saturation-curve and a neighbouring one, calculation seems to show that the limits of variation must be extremely small. There would be no discontinuity on the Thomson isothermal where it cuts the saturation-curve, but of its exact trend we know nothing. [Errata on p. 1302.] R. E. B.

REFERENCES.

1258. *Thermal Conductivity of Lead.* **F. L. Bishop.** (Amer. Acad., Proc. 41. No. 31. pp. 671–689, May, 1906.)—The experimental method described in Abstract No. 729 (1906) is here applied to lead. The same general arrangements were employed, and very full details of them are given, as well as of the measurements made and their correction for possible error. The shell used had a thickness of 5·045 cm. and an external radius of 8·742 cm., and it was electrolytically coated with nickel to a depth of 0·7 mm. Within the range of temperatures used, viz., from 22° to 103° C., the specific heat was found to be $0·06655\ (1 - 0·00154t)$. R. E. B.

1259. *The Plug Experiment.* **E. Buckingham.** (Phil. Mag. 11. pp. 678–685, May, 1906.)—While containing nothing new, this paper puts very clearly how absolute temperatures may be definitely determined, pointing out the experimental data that must be acquired according to the method used. [See Abstract No. 2625 (1904).] R. E. B.

1260. *Rate of Vaporisation of Superheated Water.* **G. Jaumann.** (Phys. Zeitschr. 7. pp. 241–242, April 1, 1906.)—The author thinks that from the shape of the steam-jet that accompanies a jet of superheated water on its exit from a boiler into free air the rate of vaporisation can be calculated [but his mathematical theory seems quite inadmissible as he considers the velocity to be the same at all points in the jets and writes down a wrong expression for the cooling produced by the evaporation]. R. E. B.

SOUND.

1261. *Longitudinal Vibrations of a Rubbed String.* **H. N. Davis.** (Amer. Acad., Proc. 41. No. 32. pp. 693–727, May, 1906.)—The transverse vibrations of a bowed string are known from the work of Helmholtz and that of Krigar-Menzel and Raps. The present paper deals with the longitudinal vibrations excited in an analogous manner, the "bow" in this case being a chamois-covered wheel dusted with powdered rosin. In order to give an unbroken rubbing surface the chamois was cut from a skin in the form of a ring and stretched over the edge of the wheel, this method being found satisfactory. The observations of the motion of the string were made with the help of glass balls from 0·1 mm. to 0·2 mm. in diam., formed by melting the end of a fine glass fibre in a flame. These were then broken off the fibre and fastened on the wire with a touch of shellac. When illuminated from the side by a Nernst-lamp filament behind a small hole in a screen and observed through a stationary microscope, such a ball, acting as a spherical mirror, gives a bright point image of the source. When the wire is vibrating, this point of light becomes a line whose half-length gives the amplitude for the place in question. To find the displacement of any given part of the wire as a function of the time, the following method was adopted. The point of a fine needle was broken off and fastened to the wire with shellac, and a microscope slide with a very light coating of smoke was drawn under it by hand while the wire was vibrating. The combined result of the various observations shows that the longitudinal vibrations of a string are closely analogous to the transverse ones. To plot the displacement u of any portion of the string at any time as a function of x and t requires a three-dimensional graph, or a surface in solid space. The author represents such solid graphs by their contours as is done in maps. A number of such figures are given for the more important cases. E. H. B.

1262. *Electrical Music.* (Scientific American, 94. pp. 268–269, March 31, 1906.)—By means of a system proposed by T. Cahill, music is generated at a central station in the shape of electrical vibrations and thence distributed by means of wires to hotels, clubs, and parlours, in each of which music is heard as if the performers were present, with pure, clear notes and chords, as loud as if an orchestra were on the spot. By the Cahill system, the music is initiated as electrical vibrations; the expression is controlled by electrical means, distributed electrically, and only converted into aerial vibrations by telephone receivers at the distant stations. To originate the notes, directly-coupled inductor alternators are used, and these are controlled by an ordinary two-manual keyboard. Tone-mixing transformers are used, analogous in their effects to the mixture stops of organs. Thus a prime alone produces a clear pure flute note, the prime with third and fourth partials gives a clarionet tone, whilst a combination in which the seventh and eighth partials are strong gives the characteristic blare of the brass instruments. E. H. B.

REFERENCE.

1263. *The Vowel A° (as in Raw), O (as in Rode), U (as in Rude).* **L. Bevier, Jr.** (Phys. Rev. 21. pp. 80–89, Aug., 1905.)

ELECTRICITY AND MAGNETISM.

THEORY, ELECTROSTATICS, AND ATMOSPHERIC ELECTRICITY.

1264. *Stability of Electrons.* **P. Ehrenfest.** (Phys. Zeitschr. 7. pp. 302–303, May 1, 1906.)—Since Kaufmann failed to discriminate experimentally between Abraham's rigid electron and the deformable electron proposed by Bucherer and Langevin [see Abstract No. 337 (1906)], the author approaches the problem from the point of view of stability. The stability of Abraham's electron is guaranteed by its rigidity. Bucherer and Langevin postulate only a constant volume. Now by Liapounoff's theorem, the potential energy of all volumes containing mutually attractive matter is a minimum when the volume is spherical. Conversely, it is a maximum for mutually repelling matter. Hence, when the sphere is subjected to any disturbance which alters its shape, that alteration will tend to increase. The sphere is unstable. This argument applies both to a surface charge and a volume charge. The author admits that the difficulty is only theoretical, and can be got rid of by simply postulating a given shape for any given velocity. [See also Abstract No. 947 (1906).] E. E. F.

1265. *Change of Resistance with Induction.* **E. Bose.** (Phys. Zeitschr. 7. pp. 373–375, June 1, 1906. Phys. Inst., Göttingen. Écl. Électr. 47. pp. 463–465, June 23, 1906.)—A thin sheet or deposit of platinum, forming one arm of a Wheatstone bridge, is enclosed between glass plates carrying coatings of tin-foil. Both coatings are connected to one pole of an influence machine, the other pole of which, and also the bridge wire, is earthed. Four thin Pt layers on mica, such as are used for resistance purposes, were tested. These had resistances of 326, 219, 52·8 and 1,600 ohms, and the observed changes of resistance were 0·51, 0·30, 0·10, and 5·5 ohms respectively; the capacity of the condenser formed by the metallic layers was 75 cm. on the average, and the p.d. given by the machine about 76 electrostatic units. Assuming the conductivity of platinum for the deposits, the thicknesses of the latter are calculated, and also the change in the number of electrons per unit of volume. Assuming, further, that the resistance of a deposit is inversely proportional to the number of electrons contained, the average value for the number of electrons per unit of volume, calculated from the observed changes of resistance, is 1×10^{22}, which agrees well with the values hitherto found. The paper is a preliminary one, and more accurate experiments are in progress. The author, however, throws open the subject to other experimenters, and also requests the loan of metallic deposits.

G. E. A.

1266. *The Watt and the Magnetising Electromotive Force.* **A. Nouguier.** (Écl. Électr. 47. pp. 81–86, April 21; 121–125, April 28; 166–174, May 5; and pp. 201–209, May 12, 1906.)—The importance of defining the watt and the magnetising e.m.f. instead of the watt and the magnetising current is pointed out. When this is done it is possible to give very simple analytical expressions for the watt and the magnetising power at every instant. The watt power furnishes the energy required for mechanical, thermal, chemical, &c., operations, and the magnetising power is storing or obtaining energy from inductive coils and condensers. The magnetising power adds nothing to the average power. For the case of an ironless circuit the watt power is Ri^2 and the magnetising power $Li\,di/dt$. If i be given by the series $\Sigma I_{2n+1} \sin[(2n+1)\omega t + a_{2n+1}]$ then the applied p.d. is given by

$$\begin{aligned} e &= \Sigma E_{2n+1} \sin[(2n+1)\omega t + a_{2n+1} + \phi_{2n+1}] \\ &= \Sigma E_{2n+1} \cos\phi_{2n+1} \sin[(2n+1\,\omega t + a_{2n+1}] \\ &\quad + \Sigma E_{2n+1} \sin\phi_{2n+1} \cos[(2n+1)\omega t + a_{2n+1}] \\ &= e_w + e_m, \end{aligned}$$

where e_w is the watt electromotive force, and e_m is the magnetising electromotive force. If there be another e.m.f. in the circuit we can resolve it in a similar manner into two components e'_w and e'_m. It is easy to show that $e_w i - e'_w i = Ri^2$ and $e_m i - e'_m i = L i\,di/dt$, and hence $(e_w - e'_w)i$ is the watt power, and $(e_m - e'_m)i$ is the magnetising power. The author next shows that Ohm's law applies, when we merely consider the quantities e_w and Ri. For instance we have $(e_w - e'_w)/R = i$. Similarly we have a law analogous to Ohm's law for the magnetising e.m.f.'s ; $(e_m - e'_m)/L = di/dt$. The laws of Kirchhoff also apply for

$$\Sigma e - \Sigma e' = \Sigma Ri + \Sigma L\,di/dt, \quad \Sigma e_w - \Sigma e'_w = \Sigma Ri, \text{ \&c.}$$

According to another definition of the watt e.m.f. it equals $V \cos\phi$; where $\cos\phi$ is the power-factor of the circuit. The author calls this the generalised component of the watt e.m.f. in order to distinguish it from the instantaneous component given above. Similarly he calls $V \sin\phi$ the generalised component of the magnetising e.m.f. In conclusion the author indicates how his methods, which are extensions of Boucherot's, can be applied in practice.

A. R.

1267. *Symmetrical Electrical Vibrations of Conducting Surfaces of Revolution.* **J. W. Nicholson.** (Phil. Mag. 11. pp. 703–721, May, 1906.)—In a previous paper [Abstract No. 2073 (1905)] were discussed the possible electrical periods of the space between two perfectly conducting elliptic cylinders belonging to a confocal system. The present paper deals with the simpler surfaces of revolution, including cylinders, whose vibrations admit readily of analytical treatment. The electric and magnetic vectors are expressed in terms of two potential functions satisfying a certain differential equation. A conjugate transformation of the co-ordinates is then made, and it is shown that, excluding elliptic functions, solutions are possible for the sphere, spheroid, cone, paraboloid and hyperboloid of revolution. The anchor ring does not admit of a solution by this method. The various cases are then discussed in detail, and solved in terms of Bessel functions.

E. H. B.

1268. *Tubular Lightning Conductor Crushed by a Discharge.* **J. A. Pollock** and **S. H. Barraclough.** (Roy. Soc. N.S. Wales, Journ. and Proc. 39. pp. 131–138, 1905.)—The top of a copper tube, of external diameter 18 mm. and thickness 1 mm., just below its solid joint with a ball finial, weighing 3½ lbs., which was struck by lightning, must have been heated by the discharge, rendered plastic, and then crushed into longitudinal folds under the electrodynamic action of the flash. There was no appearance of fusion, but the occurrence of a plastic condition was shown by a buckling under the small weight of the finial. In the absence of necessary data, only a qualitative discussion of the circumstances is possible, but it is calculated that for the tube under consideration, the mechanical effect due to a current of C amperes is equivalent to that due to a pressure of $(C/22000)^2$ atmospheres on the outside of the tube. R. E. B.

1269. *Diminution of the Mobility of Ions in Mist.* **J. Elster** and **H. Geitel.** (Phys. Zeitschr. 7. pp. 870–871, June 1, 1906.)—A description of two experiments. (1) Even in the presence of strong ionising processes the conductivity of air is kept low by means of fog or mist. This fact is used to demonstrate the positive electrification of radium when giving off β-rays. A small quantity of radium bromide contained in a sealed glass tube is enveloped in thin Al-foil and placed within a large earthed cylindrical zinc vessel. When the tube is connected to a quadrant electrometer, a small negative deflection is produced. If the vessel be now filled with sal-ammoniac vapour, the deflection of the electrometer is reversed, a maximum of about + 5 volts being reached by increasing the density of the vapour. (2) Layers of fog or mist resting on the ground exhibit, in the normal electric field of the earth, a positive volume charge. A similar effect is produced by filling a large shallow metal saucer with CO_2 gas laden with sal-ammoniac vapour. The saucer is connected with a quadrant electrometer, both being earthed to begin with. A parallel metal plate is fixed 20 cm. above the saucer, insulated and charged to a few hundred volts by means of a dry pile. A source of ions is then introduced into the electric field between the two metals; in a few minutes, with a positive upper plate, the vapour in the saucer is charged positively. This is shown by removing the source of ions. After earthing and again insulating the saucer the vapour is suddenly blown away, and the electrometer diverges with negative electricity, which had been held to the saucer by induction. G. E. A.

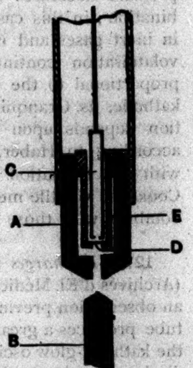
1270. *Ionisation of Air.* **H. Schering.** (Ann. d. Physik, 20. 1. pp. 174–195, May 11, 1906. Extract from Dissertation, Göttingen, 1904.)—In this paper the author points out that Elster and Geitel's apparatus is not suitable for the absolute quantitative measurement of ionisation, which was the object of the experiments described. Measurements were carried out as follows: The potential was taken every minute, or for very slow diminution every 3 or 5 min. These were then grouped, mean values being taken (say) for every 5, so as to avoid as far as possible errors of observation. The electroscope used was read by means of an Elster and Geitel reflecting scale, free from parallax. The potential drop in the electroscope itself was only about 2 or 3 volts per hour, and could be neglected. Experiments were carried out in many different rooms, and the apparatus was altered several times. Tables and diagrams are given of the results, which are compared with those of Gerdien. The specific ionic velocities obtained are less than the values 1·5 and 1·3, which Gerdien obtained for the open air, but the ratio of the velocity of the positive to that of the negative ion is the same. [See also Abstracts Nos. 1281 and 2018 (1900).] A. W.

DISCHARGE AND OSCILLATIONS.

1271. *Velocities of the Ions of Alkali Salt Vapours at High Temperatures.* **H. A. Wilson.** (Phil. Mag. 11. pp. 790–798, June, 1906. Paper communicated by the Physical Society, March 9, 1906.)—A summary is given of the previous results of the author, and also of those of Marx and Moreau.

The experiments of Marx and the writer agree in showing that all alkali salt vapours in flames give ions, having under the same conditions nearly equal velocities, and that the velocity of the negative ions is much greater than that of the positive ions. The velocity of the negative ions is about 1,000 cm. per sec. From Moreau's experiments with large concentrations the sodium ions seem to have higher velocities than the potassium ions, but if his results are compared, taking such concentrations that the flame has the same conductivity for the potassium salts as for the sodium salts, the relative velocities of the ions are obtained free from error due to variations of the potential gradient with the conductivity of the flame. Compared thus the velocities found by Moreau are very nearly the same for potassium salts as for sodium salts, and his observations agree with those of Wilson and Marx in supporting the view that all alkali salts in flames give ions having nearly the same velocities. J. J. S.

1272. *Radiant Matter in the Arc.* **A. A. Campbell Swinton.** (Phil. Mag. 11. pp. 829–831, June, 1906.)—In a previous paper [Abstract No. 147 (1906)] the author gave experimental evidence of the truth of J. J. Thomson's ionic theory of the electric arc. In the present paper he describes an experiment, in which similar apparatus is used, to ascertain whether the moving ions can pass through earthed metallic diaphragms. The arrangement of the electrodes is shown in the Fig. A and B are the arc carbons, D is an aluminium diaphragm 0·00265 mm. thick, covering the aperture in the earthed brass cylinder E, C a Faraday cylinder connected to an electrometer. It was found that ions were stopped by the diaphragm, but that the moving particles from B, when the latter was positive, frequently made minute perforations, through which the positive ions passed and communicated a positive charge to C. On replacing the diaphragm by fine wire gauze, the Faraday cylinder received ionic charges either negative or positive in sign, according to the polarity of B; showing that the carriers of electricity in the arc will pass through minutely perforated earthed metallic screens without completely losing their charges, but not through continuous metallic diaphragms of the thickness used. J. D. C.



1273. *Kathode Volatilisation of Metals in Rarefied Gases.* **V. Kohlschütter** and **R. Müller.** (Zeitschr. Elektrochem. 12. pp. 365–377, May 18, 1906. From the Chem. Inst. d. Univ., Strassburg.)—With the aid of special apparatus, the authors study the volatilisation by the glow discharge of wire kathodes joined to an induction apparatus, in pure gases. When the easily fusible metals Pb, Sn, Cd are disregarded, the order of volatility in air which Crookes had found for these discharges, is approximately—iridium does not fit in—the inverted voltaic series of the metals. But the phenomena are complicated, because the volatilisation does not always begin immediately after switching on the current; there may be retardation for many minutes. Aluminium, which had so far been regarded as practically non-volatilisable, is indeed not pulverised in the gases H, O, N, but there is some effect in He, and a strong volatilisation in A; the retardation in A lasted in one instance over an hour, after which 0·9 mgm. of Al was volatilised in 25 min.; the deposited metal forms a black mirror iridescent somewhat like steel. That Al is attacked by the "noble" gases Ne, Kr, Xe, He had meanwhile been observed also by S. Valentiner and R. Schmidt in their experiments on the isolation of those gases [see Abstract No. 214 (1906)]. Iron is volatilisable only to a slight extent, which is practically the same for the different gases. Copper is rather more volatile, particularly in He, silver more volatile still, especially in A, the order being N, He, H, O, A; the mirror edges of Ag are deep blue in transparent light. Platinum is more readily volatilised in N and O than in He, H, A; the order for gold is He, H, N, O, A (maximum volatility); for cadmium H, He, N, O, A; 147·5 mgm. of Cd were volatilised within 80 min. in A against 1 or 3 mgm. in the other gases, and the retardation was pronounced in N, O, A. The gas pressure in the tube decreases, as a rule, when the discharge is continued, and may increase again and become constant. The authors find that each metal gives in each gas a characteristic pressure curve. The increase in pressure seems to be due to a generation of hydrogen, produced by the electrolysis of hydroxide layers on kathodes of Al, Cd, Fe; there is little volatilisation in this case. In N and O the pressure decreases for all the metals, owing probably to chemical combination; in this case the volatilisation is strong. With the noble metals in inert gases and in hydrogen, the pressure soon becomes constant while volatilisation continues. In air the loss in weight of the kathode is proportional to the current intensity, and to the drop of potential at the kathode, as Granquist found. The researches indicate that the volatilisation depends upon the affinity between the metal and the gas, just as, according to Haber, the kathode disintegration in alkaline liquids starts with the formation of a natride. The vapour-density determinations by Cooke of volatile metals in He and A, also show that Sn and Cd tend to combine with those inert gases at 1,200 or 1,300° C. H. B.

1274. *Discharges through Röngten-ray Tubes.* **S. Leduc** and **F. Morin.** (Archives d'Él. Médicale, 14 pp. 429–430, June 10, 1906.)—The authors confirm an observation previously published, that the intercalation of a Röntgen-ray tube produces a great shortening in the duration of discharge, as shown by the kathode-glow oscillograph. A photograph is reproduced showing that the discharge without tube (of 3-cm. equivalent spark) lasts about 0·110 sec., and with the tube 0·009 sec. [wrongly given as 0·090], this being over 10 times as long as was found by Broca and Turchini (0·0008 sec.). [100 times as long is given in original, based upon the value 0·090.] It is noteworthy that the insertion of the tube does not alter the amplitude corresponding to the maximum intensity, but only the duration, of the discharge, which is held to diminish the practical value of this type of oscillograph. L. H. W.

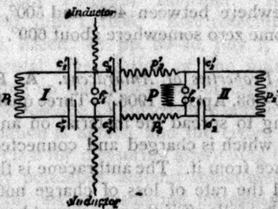
1275. *Production of Electric Vibrations by Oscillatory Charging.* **W. B. v. Czudnochowski.** (Phys. Zeitschr. 7. pp. 183–185, March 15, 1906.)—Two small Leyden jars, whose outside coatings are connected to one another through an inductance, and whose inside coatings are respectively connected to an aerial and an earth wire, form part of the transmitter of a wireless telegraph station. The inductance is broken at its middle point by a spark-gap. In parallel with the inductance, between the outer coatings of the small jars, are a spark-gap, a large capacity (Leyden jar) and another spark-gap. The coatings of the large jar are also connected to the secondary terminals of an induction coil. The charge of the large jar spa ght and left, to the outer coatings of the small ones, causing oscillations en these latter and the aerial and earth through the inductance. The au nsiders that the sudden charging of the small jars by the oscillatory s of the large one may provide a means for producing a more nearly co ous series of electrical waves than has hitherto been possible.

J. E.-M.

1276. *Determination of Resonance Curves and D g by the Cymometer.* **G. B. Dyke.** (Phil. Mag. 11. pp. 665–678, May, 19 Communicated by the Physical Soc., March 23, 1906.) The neon tube lly employed with the cymometer is merely a maximum indicator, and s not measure the current. In order to obtain the actual values, in the hbourhood of the maximum, which are necessary for a determination of resonance curve and the logarithmic decrement, a type of thermo-ammete used, which had small capacity and inductance and a calculable dampin The cymometer was placed near the primary circuit, whose damping coeff t was required. A series of simultaneous readings of R.M.S. current and fr ncy were then taken, and from them a resonance curve was plotted. An a iary resistance was then put in circuit, and another series of readings taken From the two sets of readings it is then possible to determine the decr nts of both primary and secondary circuits by means of Bjerknes' and Dr 's formulæ.

J. E.-M.

1277. *Method of obtaining Oscillations in Different Phases.* **Mandelstam** and **N. Papalexi.** (Phys. Zeitschr. 7. pp. 303–306, M 1, 1906 Phys. Inst. d. Univ., Strassburg, March, 1906. Écl. Électr. 47. p 313–316, May 26, 1906.)—The authors, at the suggestion of F. Braun, have evised a method by which two oscillatory currents of sine wave-form and circuits practically independent of one another, may be started with a diff ence of phase. In Fig. 1, P, *p* are inductances; *c*, capacities; and *f*, spark- ps. P is a very large inductance which permits the passage of the slowly- rying current during charging, but acts as a perfect choking coil during th oscillatory discharge. During charging the capacities c'_1, c''_1, and c'_2, c''_2, are here-



fore charged, and not c'_2, c''_2. The discharge, therefore, takes place first at f_1, and oscillations commence simultaneously in circuits I. and III. The current in I. is then represented by the equation—

$$i_1 = -\frac{\psi}{p_1 \nu} \epsilon^{-\delta t} \sin \nu t$$

where ψ is sparking-potential of f_1, ν the frequency, and δ the damping. After the expiration of a certain time, t_1, which is determined by the constants of the circuit III., a spark occ f_2 and oscillations begin in circuit II., the current in which is represe y the equation—

$$i_2 = \quad {}^{\delta(t-t_1)} \sin[\nu(t-t_1)+a_2]$$

Henceforward there is hase-difference of $\gamma = \nu t_1 - a_2$ between the currents in I. and II. T ermine the constants t_1, a_2, a_3, considerations of the energy in the ci are gone into, the result being that $t_1 = \pi/n$; $a_3 = \pi$; and $a_2 = \psi$ 2 $(c_2 + c_3)$. The phase-difference is therefore $\gamma = (\pi/n)(\nu - n)$. Th perimental observations of the phase-difference were made by Brau ethod [see Abstract No. 571 (1906)], a bolometer being used, in the br form devised by Tissot. The results demonstrated the accuracy of the mula for the phase-difference given above. [For further results obta with above method, see also Abstract No. 791B (1906).]

J. E.-M.

ELEC CAL PROPERTIES AND INSTRUMENTS.

1278. *Thom effect.* **E. Lecher.** (Akad. Wiss. Wien, Sitz. Ber. 114. 2a. pp. 1599–1 Dec., 1905. From the Phys. Inst. of the German Univ., Prague. Écl. ectr. 47. pp. 178–180, May 5, 1906.)—A fuller account of the author's deter nations of the Thomson-effect [see Abstract No. 155 (1906)]. In silver and opper the effect is positive, and is represented in terms of rising tempe ure by straight lines sloping upwards towards the higher temperatures. e slope in both metals is nearly the same, but the effect is nearly twic s great in silver as in copper. In silver the Thomson-effect is represente by the equation $\sigma = (7{\cdot}368 + 0{\cdot}00887t) \times 10^{-7}$ gm.-cal. per coulomb. For copper the equation is $\sigma = (3{\cdot}01 + 0{\cdot}00662t)\,10^{-7}$. The line rises somewhat more slowly than would correspond to the absolute temperature, bu s never observed to fall. In iron and constantan, on the other hand, the eff t is negative, and is represented by the equations of the second degree viz., for iron, $\sigma = -(1{\cdot}860 + 0{\cdot}02057t - 0{\cdot}00005120t^2)\,10^{-5}$; for constantan, $\sigma = -(4{\cdot}73 + 0{\cdot}0061t - 0{\cdot}000024t^2)\,10^{-6}$. The iron curve is more decidedly curved than the constantan curve. It points towards the axis of abscissæ somewhere between 400° and 500°, whereas the effect in constantan would become zero somewhere about 600°. E. E. F.

1279. *Photo-electric Properties of Anthracene.* **A. Pochettino.** (Accad. Lincei, Atti, 15. pp. 355–363, April 1, 1906.)—Three qualities of anthracene are used, the method being to spread the material on an earthed plate and to bring a metallic gauze which is charged and connected to the electrometer, to within a small distance from it. The anthracene is then illuminated by the light from an arc, and the rate of loss of charge noted. The rate of discharge is considerable, but falls off if the experiment be several times repeated, showing a fatigue. The substance recovers on being placed in the dark for several hours. This fatigue may be due to the fact that the surface layer of the crystals or powder of the substance soon acquires in the ultra-violet light an electric charge which is lost extremely slowly. With the fused substance the photo-electric effect is much greater, and the fatigue so small as to be hardly noticeable. Experiments are then described in which a strong transverse magnetic field is applied, in order to show by the deflection of the ions whether the effect is a true photo-electric effect, as in the case of zinc and aluminium. With the field the leak is slower than without it, showing that the effect is of the ordinary photo-electric character. Several other substances are examined in a similar manner. S. G. S.

1280. *Conductivity of Ozonised Air.* **G. A. Vosmaer.** (Electrician, 57. pp. 288–289, June 8, 1906.)—Using a 20-kw. 10,000-volt ozone plant of his own design [see Abstract No. 562B (1905)], the author finds that when the ozonised air is allowed to remain in the apparatus the resistance to the passage of the discharge increases, the secondary voltage having to be raised 20 per cent. for an ozone content of about 8 gm. per cub. m. of air, as compared with a content of 2 gm. per cub. m. Experiments with a gold-leaf electroscope show that ozonised air has no effect in discharging the electroscope, whether the latter is charged positively or negatively. Against the view that ozonisation is due to the ultra-violet light of the discharge, it is pointed out that the luminosity and output of one discharger is greatly diminished by the proximity of another; and if brought very near together both are nearly extinguished. L. H. W.

1281. *Large* v. *Small Spark-coils.* **Wertheim-Salomonson.** (Archives d'Él. Médicale, 14. pp. 290–301, April 25, 1906. Extract from Fortschritte auf dem Gebiete der Röntgenstrahlen, 8. pp. 254–260.)—A discussion of the relative advantages of large and small coils for Röngten-ray work. Although the smaller coils (20–30 cm. spark) are worked at a higher efficiency than large coils (50–60 cm. spark), the latter have the advantage in supplying a higher voltage and having a greater reserve. These remarks do not apply to still smaller coils, which are disadvantageous. The theoretical deductions have been confirmed experimentally, the author having found that the intensity J of the Röngten rays from a single discharge may be expressed by $J = \text{const.} \times (L^2 - l^2)/d^2$, where L is the spark-length employed, l the length of equivalent spark, and d the distance of the plate from the antikathode, in cm. (Zeitschr. f. Elektrotherapie, 10. p. 321, 1904). The constant depends upon the tube, and varies between 0·02 and 0·05. J is in candle-metre-second units. [See also Abstract No. 760 (1906).] L. H. W.

1282. *The Electrostatic Potential Indicator.* **H. Fischer.** (Phys. Zeitschr. 7. pp. 376–380, June 1, 1906. Elektrotechn. Inst. d. techn. Hochschule, München. Écl. Électr. 48. pp. 39–40, July 7, 1906.)—A preliminary paper on an experimental investigation of the influence of the time of charging and discharging on the indications of the electrometer. That the indications of the electroscope or quadrant electrometer are independent of the period of alternation is denied, and the errors which occur in using an instrument of this class for measuring alternating potentials, having been standardised on steady potentials, amount sometimes to over 50 per cent. The cause of this is the use of insulating material in the construction of the instrument; and investigations made by means of a quadrant electrometer made entirely of metal confirm the conclusion that in an instrument entirely free from dielectric material the influence of the time of duration of charge disappears. The theory of the instrument is touched upon—a fuller paper is to appear in the Annalen—and a description of an electrometer with variable range is also indicated. G. E. A.

1283. *Instrument for Illustrating the Magnetic Properties of Iron.* **A. H. Peake.** (Cambridge Phil. Soc., Proc. 13. pp. 250–257, May 15, 1906.)—The instrument is designed so that numbers proportional to B and H can be simultaneously read upon two scales. The magnetic substance is suspended vertically in a magnetic field due to permanent magnets, which is normally horizontal. On slightly rotating the field out of the horizontal there will be a magnetising component of the field parallel to the axis of the specimen, and therefore a couple acting upon it, which is balanced by a gravitational control and is proportional to the magnetisation. Thus, for small deflections, the deviation of the specimen from the vertical is proportional to its magnetisation, and the angle between the specimen and the field is proportional to the magnetising field. The construction of the instrument and its calibration are described. The instrument can be used for illustration, but not for the purposes of exact measurement. S. G. S.

ALTERNATING CURRENTS AND MAGNETISM.

1284. *Susceptibility of Iron in Colloidal Solution.* **E. F. Burton** and **P. Phillips.** (Cambridge Phil. Soc., Proc. 13. pp. 260–268, May 15, 1906.)—The authors determined the magnetic susceptibility of iron in colloidal solutions obtained by sparking with a current of 6·5 amps. at 40 volts between soft iron electrodes beneath the surface of pure methyl alcohol. The iron in these solutions was found to have a susceptibility over 13 times as great as in ferric or ferrous salts. It is suggested that in these colloidal solutions either (1) the particles in suspension are made of homogeneous iron exhibiting magnetic properties hitherto unknown for this element, or (2) each particle consists of a core of pure iron surrounded by (say) hydroxide of iron. D. H. J.

1285. *Magnetic Observations in Egypt during Solar Eclipse, Aug. 30, 1905.* **E. B. H. Wade.** (Terrestrial Magnetism, 11. pp. 45–48, March, 1906.)—Three parties were detailed from the Egyptian Survey Department to make magnetic observations during the total eclipse, and were equipped with absolute instruments of the Kew pattern. Scale readings of the declination collimator were made daily at every minute from 10^h–16^h G.M.T., the series being preceded and followed by complete absolute sets; of these the observations from Aug. 26 to 30 have been used in the discussion. Curves are given showing the perturbations at each of the three stations. It is stated that, except at one of the stations, Gertasse, there was no disturbance directly associated with totality, though it is not so certain that the eclipse, taken as a whole, had no disturbing effect. C. P. B.

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1286. *Integration of Electrodynamic Equations.* **R. Marcolongo.** (Accad. Lincei, Atti, 15. pp. 344–349, April 1, 1906.)—A method of solving the fundamental equations of electrodynamics given by Lorentz when the movement of the electrons at every point in space for every value of the time is known, the further supposition being made that the initial state is one of rest, and that all the functions considered have zero value at infinity. S. G. S.

1287. *Field Due to a Rotating Charged Sphere.* **A. H. Bucherer.** (Phys. Zeitschr. 7. pp. 256–257, April 15, 1906.)—A new and simpler method of calculating the potential at a point moving with a rotating charged sphere, and the resulting force on a pole placed at the point. S. G. S.

1288. *Extension of Stefan's Development of the Electromagnetic Field for Moving Media.* **E. Kohl.** (Ann. d. Physik, 20. 1. pp. 1–34, May 11, 1906.)—A mathematical discussion based on the two assumptions that, first, electricity is to be considered as continuous, and second, that the two electricities under the influence of the same force flow with equal strengths but in opposite senses; a different mobility of the two is thus fundamentally excluded. The phenomena of kathode and canal rays, apparently opposed to the above, are attributed to the difference of the masses associated with each. E. H. B.

1289. *A Rotating Electromotive Field.* **R. Gans.** (Phys. Zeitschr. 7. pp. 342–347, May 15, 1906.)—A mathematical discussion of the question raised by A. Pflüger as to whether the earth's magnetic field may be traced to the rotation of the earth as an electrically charged body. [See Abstract No. 1638 (1905).] E. H. B.

1290. *Electron Theory.* **P. Hertz.** (Phys. Zeitschr. 7. pp. 347–350, May 15, 1906.)—A mathematical discussion of A. Sommerfeld's treatise of electrons at or exceeding the speed of light [see Abstract No. 2233 (1905)]. It is maintained that there is a superior limit to the forces that can act upon electrons, or, in other words, that forces may be conceived so great that no possible motions correspond to them. [See also Abstract No. 266 (1906).] E. H. B.

1291. *Electromagnetic Phenomena in Moving Media.* **G. Jaumann.** (Akad. Wiss. Wien, Sitz. Ber. 114. 2a. pp. 1635–1684, Dec., 1905. Ann. d. Physik, 19. 5. pp. 881–917, April 10, 1906.)—A mathematical treatise on the basis of Maxwell's theory but extended to moving media, and by which the endeavour is made to explain various recent experimental results such as Röntgen's phenomenon and Michelson's work. E. H. B.

1292. *Oscillatory Discharges.* **N. Boulgakov.** (Acad. Sci. St. Pétersbourg, Mém. 17. 4. pp. 1–8, 1905.)—The author shows how the curve of an oscillatory discharge may be obtained by means of an ordinary galvanometer by taking two sets of observations, one with a resistance and inductance in the discharge circuit, and the other with the same resistance and no inductance but that of the galvanometer itself. E. E. F.

1293. *Rectifying Valves for High-frequency Currents.* **J. A. Fleming.** (Phil. Mag. 11. pp. 659–665, May, 1906. Communicated by the Physical Society.)—Further particulars as to the construction and applications of the vacuum valve described in Abstract No. 807 (1905). A form of multiple-gap discharger with carbon electrodes is described, which is recommended for quantitative work. L. H. W.

1294. *Infinite Metal Cylinder and Hertz Waves.* **W. Seitz.** (Ann. d. Physik, 19. 3. pp. 554–566, March 2, 1906.)—In a recent work on this subject by the author [Abstract No. 1275 (1905)] the need for emendations has been noticed through a work on the same topic by W. v. Ignatowski. [See Abstract No. 134 (1906).] These points are here examined and the new values, where appreciably different, fully calculated, tabulated, and plotted; some of the values are, however, not materially changed by the corrections thus introduced. E. H. B.

1295. *Contact-e.m.f. between Metals and Liquids.* **C. Nordmann.** (Comptes Rendus, 142. pp. 626–629, March 12, 1906.)—The author, in the course of recent work on ions [see Abstract No. 822 (1905)], found that when a sufficiently sensitive electrometer is connected to an insulated metallic receiver upon which falls a conducting liquid (like $MgSO_4$, say) drop by drop, then the needle asymptotes to a deflection corresponding to a small fraction of a volt. This deflection varies with the metal and the liquid used, and is attributed to a contact-e.m.f. between the two. E. H. B.

1296. *Magnetic Induction due to Sphere of Isotropic Material.* **T. Boggio.** (Comptes Rendus, 142. pp. 701–703, March 19, 1906.)—The author gives a new method of calculating the induction due to a sphere of isotropic magnetic material by means of definite integrals instead of by the aid of a series of spherical functions, as usually performed. S. G. S.

1297. *Lightning Flashes and their Photography.* **B. Walter.** (Ann. d. Physik, 19. 5. pp. 1032–1044, April 10, 1906. Phys. Staatslaboratorium, Hamburg, Feb., 1906.)—A reply to Schmidt [Ibid. p. 215, Jan. 18, 1906] giving explanations in support of his theory of residual lightning discharges [see Abstract No. 386 (1906)]. Other sections of the paper treat of inequalities in the different partial discharges of a lightning flash, striated formations in the flash, and estimation of the height of a thunder-cloud. A measurement under the last heading gave the height of a cloud as 1·3–2·7 km. G. E. A.

1298. *Electrical Resistivity of Iron and Steel at High Temperatures.* **C. Hering.** (Electrochem. Ind., N.Y. 4. p. 47, Feb., 1906.)—In connection with Gin's paper [see Abstract No. 1109 (1906)] the author calls attention to the figure given in the original for the resistivity, viz., 0·00016 microhm-cm. This figure should evidently be one million times as great, *i.e.*, 160 microhms-cm. or 0.00016 ohm-cm. [corrected in the Abstract in some copies. In those in which on lines 3 and 4 from end, and end line, the word microhms comes *before* ohms this order should be *reversed*]. L. H. W.

1299. *Intensimetric Scale for Röntgen-ray Dosage.* **S. Tousey.** (Roentgen Soc., Journ. 2. p. 103, April, 1906. Abstract of paper read before the Amer. Electrotherapeutic Assoc., Sept. 18, 1905.)—The author proposes the adoption of an intensimetric scale for Röntgen-ray tubes based upon the distance at which visible fluorescence is produced in the ordinary box fluoroscope. In measuring the distance the eyes should first be allowed to become accustomed to the obscurity of the box and then the rays are turned on in short flashes at intervals of 15 secs. As the observer moves towards or away from the tube, a heavy metal object is moved before the fluoroscope in order to determine the greatest distance at which he sees the motion of the object. H. W. P. Y.

1300. *Cross-wire for a Leaf Electrometer.* **K. Kurz.** (Phys. Zeitschr. 7. pp. 375–376, June 1, 1906. Phys. Inst. d. Univ., Giessen, April 24, 1906.)—A small circular segment is cut out of the side of the leaf near the end and a quartz thread fastened across the gap. The position of the thread is read in a microscope with ocular scale. G. E. A.

1301. *Employment of the Electro-diapason as a Generator of Alternating Currents.* **Devaux-Charbonnel.** (Comptes Rendus, 142. pp. 953–954, April 23, 1906.)—The author points out that the electro-diapason is a somewhat peculiar generator, as may be demonstrated by means of the oscillograph, which shows that the current is by no means sinusoidal even after passing it through a transformer. Consequently its employment on telegraph lines for multiple telegraphy is difficult, as it produces very appreciable induction currents in neighbouring conductors. D. H. J.

1302. *Influence of Frequency upon Inductance of Coils.* **J. G. Coffin.** (Amer. Acad., Proc. 41. No. 34. pp. 789–803, May, 1906.)—Following the work of M. Wien and A. Sommerfeld [Abstracts Nos. 2272 (1904) and 591 (1905)] the author attacks the problem of the change of inductance with frequency, the coil being replaced by a circular current sheet. Formulæ and graphs are thus derived which represent the results sought. It is shown that, in certain cases, the *variable* part of the expression for the inductance agrees identically with that derived for a circular current sheet. E. H. B.

1303. *The Capillary Telephone.* **H. Boruttau.** (Phys. Zeitschr. 7. pp. 229–233, April 1, 1906.)—The author describes the improvements which he has effected in the capillary telephone and some tests made with the improved apparatus. L. H. W.

1304. *New Kind of Röntgen-ray Tube.* **J. Rosenthal.** (Phys. Zeitschr. 7. pp. 424–425, June 15, 1906. From paper read before the second Röntgen Congress, Berlin, April 2, 1906.)—The author describes a new type of tube which he calls an "internal filtering" tube. The filter (not described in detail, nor material stated) is so arranged that the whole beam of rays from the antikathode is intercepted by it before the rays reach the external glass wall of the bulb, thus removing the cause of the heating up of the whole tube. The filter is claimed also to effect a transformation and more equal distribution of the rays, and its advantages are discussed. The tubes are made by the Polyphos Gesell., of Munich. L. H. W.

1305. *Sensibility of the Quadrant Electrometer.* **E. Cohnstaedt.** (Phys. Zeitschr. 7. p. 380, June 1, 1906. Phys. Inst. d. techn. Hochschule, Dresden, May, 1906.)—With a number of needles of different forms the influence of the electric directing force disappeared or reversed. The form of the needle and the slot in the quadrants does not appear to be of outstanding importance; but projecting edges at the slots have to be avoided. G. E. A.

1306. *Demonstration Apparatus for Alternating Currents.* **K. Simons.** (Elektrotechn. Zeitschr. 27. pp. 448–449, May 10, 1906.)—A simple form of apparatus, consisting of a modified transformer having one of its yokes arranged so as to be capable of rotation, by means of which the generation of alternating and rectified currents, and the actions taking place in a transformer, as well as a number of other alternating-current effects, may be illustrated. A. H.

1307. *Magnetic Collimator.* **A. Berget.** (Comptes Rendus, 142. pp. 1143–1144, May 21, 1906.)—The objective of the left tube of a field-glass is covered with a bonnet containing a collimator system, formed of a lens and three total-reflection prisms, at the focus of which is a movable, transparent compass card. The function of the instrument is to view a distant point and at the same time read off its magnetic azimuth on the small compass above the bonnet. G. E. A.

1308. *Magnetism of Diamond Drill Rods.* **D. W. Johnson.** (Science, 23. p. 789, May 18, 1906.)—A case described by A. C. Lane in the 1904 Report of the Michigan Academy of Science is related in which the magnetism of iron or steel casings in deep wells was sufficiently strong to hold large-sized spikes and heavier wrenches. In the present instance when rocks free from magnetite were being drilled in a direction inclined from the vertical toward the north the drill rods became strongly magnetic. The effect is ascribed to adjacent ore bodies. G. E. A.

1309. *Heat of Magnetisation.* **E. Warburg.** (Ann. d. Physik, 19. 3. pp. 643–644, March 2, 1906.) **A. Heydweiller.** (Ibid. 20. 1. pp. 207–208, May 11, 1906.)—Warburg contests a conclusion by Delere [see Abstract No. 2273 (1905)], that during cyclic magnetisation of iron the Thomson reversible effect constitutes a not inconsiderable portion of the hysteresis heat, on the ground that he applies to an irreversible process a thermodynamic equation which is applicable to reversible processes only, and he gives a mechanical illustration of the point in question. Heydweiller replies that Delere has only followed Warburg's own method of calculation and that the illustration is beside the point. R. E. B.

1310. *Influence of Solar Activity on Magnetic Perturbations.* **W. Krebs.** (Phys. Zeitschr. 7. pp. 309–311, May 1, 1906.)—Examination of the facts indicating a probable connection between the magnetic perturbations of Nov. 12 and 15, 1905, and the sun-spot activity at those times. C. P. B.

CHEMICAL PHYSICS AND ELECTRO-CHEMISTRY.

1311. *Motion of Dissolving Crystals on Mercury.* **A. Thiel.** (Zeitschr. Elektrochem. 12. pp. 257–259, April 6, 1906. Chem. Inst. d. Univ., Münster, March 8, 1906.)—Schaum [see Abstract No. 1320 (1900)] has found that numerous substances, when introduced on to the surface of mercury under dilute sulphuric acid, exhibit remarkable motions. These can be explained by the electro-capillarity, that is, by the dependence of the surface tension of the mercury on its anodic or kathodic charge. The presence of an oxidiser acts like an anodic, and that of a reducer like a kathodic charge. In the mercury a flowing occurs in such a way that the surface disappears at places of low surface-tension, and reappears at points where the surface tension is high. All the substances used by Schaum to produce these motions are either oxidising or reducing agents. T. H. P.

1312. *Diffusion of Solutions and Molecular Weights.* **M. Yégounow.** (Comptes Rendus, 142. pp. 954–957, April 23, 1906.)—For microbiological purposes the author required to know the rate of movement of certain substances in nutritive media, and he has found a sufficient result by studying, in the case of isotonic solutions, the relation between the coefficient of diffusion, K, and the rate of movement, v, in a given section. The experiments were made with 10 per cent. gelatine contained in tubes 15 cm. long by 8 to 10 mm. wide, which were plunged to a depth of $\frac{1}{2}$ to 1 cm. in a large volume of the experimental solution. It was found that the ratio K/v is a constant for equimolecular solutions of all substances. When the concentration changes in geometrical progression, the velocity, v, changes in arithmetical progression. The molecular weight may be calculated from tables showing the relation between K and a^2 (where a is a constant for each substance, as in Stefan's formula). D. H. J.

1313. *Electro-chemical Properties of Radio-active Elements.* **R. Lucas.** (Phys. Zeitschr. 7. pp. 340–342, May 15, 1906.)—The author endeavours to establish an electro-chemical relation between radio-activity and position in the voltaic series. Since the radio-active elements have atoms which disintegrate spontaneously, and since electropositive elements are those which lose electrons easily, it is reasonable to suppose that the more radio-active an element is the more should it evince an electropositive character. This is found to be the case in a number of radio-active disintegration products. According to v. Lerch [Abstract No. 1871 (1905)], thorium X is more positive than thorium A, and the latter is more positive than thorium B. Thorium A seems to have its place somewhere near copper in the voltaic series, and thorium B a few tenths of a volt higher. A similar agreement is found in the case of radium, radium B, and radium C. That radium F is more negative than radium D and E is shown by the fact that it is precipitated upon bismuth, whereas D and E are not. Actinium is probably derived from emanium, and should, therefore, be more negative than the latter. This cannot be decided in a direct manner, but it is significant that lanthanum, the companion of emanium, is more electropositive than thorium, the companion of actinium. E. E. F.

1314. *Preparation of Boron Carbide in the Electric Furnace.* **S. A. Tucker** and **H. J. W. Bliss.** (Amer. Chem. Soc., Journ. 28. pp. 605–608, May, 1906.)—Small quantities of boron carbide have been prepared by heating a mixture of boric oxide and petroleum coke, in molecular proportions, in a resistance type of electric furnace, or by subjecting it to a powerful arc in a graphite crucible which is surrounded by a heat-insulating layer of magnesia, and forms one pole, the other consisting of a graphite rod hung vertically through the opening of the crucible. The globules of carbide obtained were found to conduct electricity, were harder than silver carbide, and resisted the action of all common acids, but decomposed with evolution of CO on treatment with fused alkali. After separating the graphite and fusion with alkaline carbonate, the compound gave on analysis 82·8 per cent. of boron, confirming its identity with the carbide B_6C investigated by Joly and by Moissan.

W. H. Si.

1315. *Retention of Helium by Platino-Iridium at High Temperatures.* **E. Dorn.** (Phys. Zeitschr. 7. p. 312, May 1, 1906.)—After referring to results of other workers, experiments are described in which cylinders of platino-iridium were employed, of 8·04 c.cm. capacity and wall thickness 0·24 mm., raised to definite temperatures in an electric furnace. The gas was kept in contact with the metal for several days, and the heating applied at intervals for some 30 min. at a time. The absorption was measured by the fall in pressure of the contained gas. The temperatures employed varied from 640° to 1,420°.

C. P. B.

1316. *Conductivity of Solutions of Ammonium Sulphate in Mixtures of Sulphuric Acid and Water.* **G. Boizard.** (Comptes Rendus, 142. pp. 1082–1084, May 14, 1906.)—The conductivity of solutions containing 1 per cent. of ammonium sulphate in mixtures of sulphuric acid and water, is greater than that of the solvent when the latter contains up to 1·8 per cent., or from 95 to 100 per cent. H_2SO_4, but is less than that of the solvent for strengths intermediate between 1·8 and 95 per cent. When the solvent contains more than 8 per cent. H_2SO_4 the difference in conductivity is proportional to the concentration, provided the latter does not exceed 1 or 2 per cent.; for stronger solutions the difference in conductivity changes less rapidly than the concentration when the solution has a lower conductivity than the solvent. Concentrated solutions in mixtures containing about 2 per cent. H_2SO_4 have greater conductivities than the solvents, weak solutions lower conductivities. For solvents containing less than 1 per cent. H_2SO_4, the conductivity at first increases more rapidly than the concentration, but the rate of increase gradually becomes less. With solutions in 95 to 25 per cent. H_2SO_4, the ratio of the conductivities of solution and solvent approaches unity as the temperature increases, but with solutions in 25 to 8 per cent., or 0·6 to 0 per cent. H_2SO_4, rise of temperature has an opposite effect. Similar properties are observed with solutions in which the ammonium sulphate is replaced by other sulphates (anhydrous or containing their water of crystallisation), bisulphates, $KMnO_4$, $(NH_4)_2HPO_4$, NaCl, KNO_3, CH_3COONa, or nitric, phosphoric, boric, acetic, benzoic, succinic, tartaric or pyruvic acids. The H_2SO_4 may also be replaced by nitric or phosphoric acid. With mixtures of water and acetic or formic acids as solvents, the solutions have always greater conductivities than the solvents.

W. H. Si.

1317. *Gold-Zinc Alloys.* **R. Vogel.** (Zeitschr. Anorg. Chem. 48. 4. pp. 319–332, March 3, 1906. Metallog. Communication from the Inst. f.

anorg. Chemie d. Univ., Göttingen.)—The method of obtaining a complete temperature-concentration diagram of these alloys and a series of photomicrographs of their structure are described. The diagram comprises sixteen distinct regions, three definite compounds—AuZn, Au_3Zn_5, and $AuZn_8$—being formed; a compound—Au_2Zn_3—whose existence would have been anticipated from the usual valencies of Au and Zn is not formed. Starting with the alloys richest in Au, up to a content of 12 per cent. Zn mixed crystals of Au and Zn are formed; then follows a short range of alloys in which a eutectic of the mixed crystals AuZn and of the crystals of the compound AuZn saturated with Au, forming another series of mixed crystals, is present—there are thus two series of mixed crystals separated by a short range of mutual insolubility. The compound AuZn forms series of mixed crystals with both Au and Zn, the latter series ending at the composition corresponding to the compound Au_3Zn_5, which then crystallises out as a homogeneous body. This compound forms mixed crystals richer in Zn only. With a concentration of 61 per cent. Zn the compound $AuZn_8$ is formed as a secondary product until at concentrations from 76 to 88·5 per cent. Zn this compound is formed as the primary crystallisation. With higher concentration of Zn mixed crystals are formed having pure Zn as their basis. These deductions from the thermal data are confirmed by examination of the microstructure of the alloys, which is illustrated by twelve photomicrographs. W. Ros.

1318. *Nickel-Antimony Alloys.* **K. Lossew.** (Zeitschr. Anorg. Chem. 49. 1. pp. 58–71, March 31, 1906. Metallog. Communication from the Inst. f. anorg. Chemie d. Univ., Göttingen.)—Gives a complete temperature-concentration diagram of the Ni-Sb series, with the thermal data upon which the diagram is based and photomicrographs of the correlated structures. The diagram shows two well-defined maxima corresponding to the compounds NiSb and Ni_5Sb_2, but many of the alloys undergo transformations at lower temperatures, and these have been traced by the author. At 612° C. the crystals of NiSb found in alloys containing from 8·0 to 32·8 per cent. Ni react with the eutectic, forming the compound Ni_4Sb_5, which appears in the micrographs as a white border around the NiSb crystals. In the alloys containing from 57 to 92·5 per cent. Ni, a reaction takes place at 677°, in which two kinds of solid solutions react to form the compound Ni_4Sb—a reaction which is reversible, and can be suppressed by quenching. The compound Ni_5Sb_2 has a polymorphic change-point at 580°. The author also describes the magnetic properties of the alloys; those with more than 57 per cent. Ni are magnetic at ordinary room temperatures, but the body Ni_4Sb entirely loses its slight permeability at 90°. W. Ros.

1319. *Brass Alloys.* **L. Guillet.** (Comptes Rendus, 142. pp. 1047–1049, May 7, 1906.)—The author arrives at the formula $A' = 100A/[100 + q(t-1)]$ in which A is the actual percentage of copper in an alloy of Cu, Zn, and a third element, q is the percentage of the third element, and A′ is the apparent percentage of Cu deduced from the microstructure by regarding the alloy as containing only Zn and from 55 to 63 per cent. Cu [see Abstract No. 2774 (1904)]; t is the percentage of the third element which is equivalent micrographically to 1 per cent. Zn, and the following values are given: for Al, $t=6$; for Si, 10; Sn, 2; Mn, 0·5; Pb, 1; Fe, 0·9; Cd, 1. Each of the triple alloys has mechanical properties which resemble more closely those of the simple Cu-Zn alloy whose actual copper content is A′, than those of the simple brass whose actual content is A. As soon as any constituent begins to appear, other than those which occur in the above-mentioned range of Cu-Zn alloys, the mechanical properties of the alloy fall considerably. Instances are given. [See also Abstract No. 887 (1905).] F. R.

1320. *Iron-Nickel-Manganese-Carbon Alloys.* **H. C. H. Carpenter, R. A. Hadfield** and **P. Longmuir.** (Inst. Mech. Engin., Proc. 4. pp. 857–959; Discussion and Correspondence, pp. 959–1041, Oct.–Dec., 1905. Engineering, 80. pp. 708–713, Nov. 24; 745–750, Dec. 1; 777 and 779–784, Dec. 8; and Discussion, pp. 822–829, Dec. 22, 1905. Iron and Steel Mag. 11. pp. 100–112, Feb., 1906. Seventh Report to the Alloys Research Committee.)—The paper describes the investigation of the mechanical, magnetic, electric, and thermal properties, the rate of corrosion, and the metallography of a series of 10 steels containing from 0 to 19·91 Ni, 0·40 to 0·52 carbon, and 0·79 to 1·03 per cent. Mn. Many of the results confirm those given by previous workers. The mechanical tests of all kinds, on the forged alloys annealed at 800° C., give the same sorts of results. Between 4·25 and 4·95 per cent. Ni, there occurs a rapid increase of tensile strength to a maximum of 110·57 tons per sq. in. at 6·42 per cent. Ni, a fall of ductility, and an increase of brittleness as shown by the bending, tension, torsion, and shock tests; this extends to about 16 per cent. Ni, where the properties slowly improve. The modulus of elasticity falls from 32×10^6 lbs. per sq. in. to $27{\cdot}3 \times 10^6$ with 7·95 per cent. Ni, and after 16 per cent. rises again. The compression strength follows changes analogous to those of the tensile strength. The impact tests were made by Stanton and Jakeman, using an apparatus in which both anvil and hammer are suspended by steel strips 12 ft. long. As a measure of hardness, the breadth of a scratch, made with a uniform load on the tool, was not found to be convenient for observation, on account of the raggedness of its edges and the obliquity of its sides. Hardness tests were made by measuring the penetration of a steel point, of a steel knife-edge (Unwin's method) and of a ball (Brinell's method). The two latter methods place the alloys in order of hardness about the same as in tensile strength, *i.e.*, varying oppositely to ductility. Some alternating-stress tests were carried out by Stanton by means of the machine described in Abstract No. 670 (1905), but these are insufficient to draw conclusions from. The resistivity rises with increasing Ni; alloys between 5 and 8 per cent. Ni lie considerably above the smooth curve followed by the rest. Campbell determined the permeabilities of the alloys; these decrease with increasing Ni, and fall into groups corresponding to the three types of structure—pearlitic, martensitic, polyhedric. The coefficients of dilatation follow a law somewhat similar to that of the resistivities. The corrosion of samples immersed for a month in 50 per cent. H_2SO_4, in sea-water, or in aerated fresh water, decreases with increasing Ni. The ranges of solidification of the alloys, and of nickel, and the critical ranges in heating and cooling were determined by the methods formerly described [see Abstract No. 1796B (1904)]. The curves are given. Because of the similarity between portions of the cooling-curve of Ni, and of those of the higher Ni alloys, the authors suggest that Ni as such is actually present in these alloys. The forged and cast alloys gave practically identical curves. The microstructure is illustrated by upwards of 100 photomicrographs; except in a few points, the authors' conclusions confirm those of Osmond and Guillet [Abstract No. 1787B (1904)] including those regarding the effects of cold working; the authors find no difficulty in restoring, by heating at 800°–900° C., the polyhedric structure of an originally polyhedric sample which has been made martensitic by working. In the *discussion*,

R. A. Hadfield added tensile tests of the series made upon specimens immersed in liquid air. All the strengths were very much greater than at ordinary temperature, and elongations less, though some of them were still considerable. [See also Abstracts Nos. 871 and 1801 (1905).] **T. Turner** referred to the sclerometer method of determining hardness. A series of scratches is made with different pressures on the diamond point, and these are compared with a standard scratch. **J. O. Arnold** considered that only a minority of the authors' micrographs supported the above classification of structures; also that the method of melting the alloys for the solidification determinations would certainly result in serious oxidation. He had made experiments showing that there was a definite alloy of about 15 per cent. Ni with iron whose ductility was largely destroyed by the presence of small amounts of carbon and Mn. **W. F. Barrett** also emphasised the effect of carbon and Mn, as shown in magnetic and electrical properties of Ni-Fe alloys. **W. Gowland** said that the relative rates of corrosion depend on the length of time the sample has been immersed; thus 1-month tests would not be very valuable. **Carpenter** said that the fact that an increase of carbon had been found on re-melting low-carbon steels showed that there was no considerable oxidation. In the *correspondence*, **P. Breuil** gives the results of some tests and photomicrographs of nickel steels, and adds the following figures for pure Ni: yield point, 11·8 tons per sq. in.; maximum stress, 27·2 tons per sq. in.; elongation, 25 per cent. **L. Guillet** explains the combined effects of Ni and Mn. [See Abstract No. 404 (1906).] He states that the effect of cold work in changing the structure of polyhedric steels to martensitic is much more marked in Ni-steels than in Mn-steels; he also emphasises that it is only those steels which are not far removed from the martensitic groups in each case, whose structure is susceptible to this change. **P. Longmuir** states that the authors made experiments which would indicate that the whole of the solidification determinations were taken under seriously oxidising conditions; but **Carpenter** does not admit this. (Engineering, 80. p. 848, Dec. 22, 1905.)—**J. O. Arnold** further criticises the method used for taking cooling curves, on the grounds that the rate of cooling is too slow and variable, and that the temperature difference between the platinum and steel cylinders varies with the rate of cooling; he illustrates by means of several curves recorded for nickel by this apparatus. F. R.

1321. *Attempts to Bessemerise Nickel Sulphide Ores by Blast enriched with Oxygen.* **R. Hesse.** (Metallurgie, 3. pp. 287–292, May 8, and pp. 375–381, June 8, 1906. Communication from the Inst. für Metallhüttenw. and Elektrometall. der kgl. techn. Hochschule, Aachen.)—In view of the successful treatment of copper sulphides by the aid of blast rich in oxygen, the same processes in the case of nickel were studied by the author, four lines of investigation being followed: (1) Experiments on the reaction between NiO and NiS; (2) Bessemerisation of nickel sulphide concentrates with blast containing increasing proportions of oxygen; (3) experiments on the production and dissociation of NiS; and (4) further experiments on the reaction between NiO and NiS. As regards (1), NiO and NiS were fused together in molecular proportions, first in an electrically-heated kryptol furnace, which, however, failed to answer the requirements, and subsequently in a coke-fired Deville furnace. In the latter case a regulus containing over 90 per cent. Ni and about 8 per cent. S was obtained, showing that although the reaction is not complete under the conditions of the experiment, there is a decided reaction between NiO and NiS. (2) The attempts at Bessemerisation showed that the

Ni itself was oxidised, the oxide entering into a slag with the siliceous lining of the converter. (3) and (4) The further study of the mode of formation and properties of NiS showed that so long as any undecomposed NiS is present this forms an alloy with the Ni. Experiments at high temperatures in an electric arc furnace showed that NiS was then dissociated, but the sulphur could never be entirely eliminated. The results as a whole show that it is not possible to obtain a useful quality of nickel by Bessemerisation.

W. Ros.

1322. *Viscosity and Fluidity.* **E. C. Bingham.** (Amer. Chem. Journ. 35. pp. 195–217, March, 1906.)—It was recently observed that mixtures of acetone with ethyl or methyl alcohol gave a linear relationship between concentration and fluidity, the relationship between concentration and viscosity being expressed by a hyperbolic curve. A similar approximately linear relationship has been found in the case of a large number of liquid mixtures and appears to have been established as a general rule. Aqueous solutions, as is well known, form an exception, and a similar abnormal relationship was found in the case of mixtures of chloroform and ether; in each case there appears to be some exceptional change accompanying the admixture, this change being evidenced by a marked contraction of volume, an evolution of heat, and a large decrease in fluidity. In the case of mixtures of methyl iodide and carbon disulphide there is a rise (instead of a fall) in the fluidity-concentration curve, and it is noteworthy that in this case the admixture is accompanied by expansion.

T. M. L.

1323. *Influence of Silver Nitrate on the Solubility of Silver Nitrite.* **A. Naumann** and **A. Rücker.** (Ber. Deut. Chem. Gesell. 38. pp. 2292–2295, 1905.)—The addition of silver nitrate to a saturated solution of the nitrite diminishes the solubility of the latter. At 18°, the saturated nitrite solution contains 3·1823 gm. = 0·02067 mol. per litre, and the solubility in presence of nitrate is given in the following table:—

Silver Nitrate added in Mol. per litre.	Silver Nitrite remaining Dissolved.		
	Found.	Calculated.	
		According to van't Hoff.	Allowing for Partial Dissociation of Silver Nitrate.
0·00258 = $\frac{1}{8}$ × 0·02067	0·01975	0·01943	0·01946
0·00517 = $\frac{1}{4}$ × 0·02067	0·01900	0·01826	0·01846
0·01033 = $\frac{1}{2}$ × 0·02067	0·01689	0·01615	0·01639
0·02067 = 1 × 0·02067	0·01435	0·01281	0·01335
0·04134 = 2 × 0·02067	0·01168	0·00843	0·00939
0·08268 = 4 × 0·02067	0·00961	0·00490	0·00573

T. H. P.

1324. *Critical Temperatures of Solutions. II. Law of Straus and Pawlewski.* **M. Centnerszwer** and **M. Zoppi.** (Zeitschr. Phys. Chem. 54. pp. 689–706, March 13, 1906. Phys.-chem. Laborat. des Polytechnikums, Riga, Nov., 1905.)—The authors find that mixtures of ether and methyl alcohol do not conform to Straus and Pawlewski's law, according to which the critical temperatures of mixtures of two volatile substances can be calculated by the law of mixtures. On mixing ether and methyl alcohol, contraction always takes place, especially when only a small proportion of the latter is taken; the specific volumes of mixtures of different compositions are given for 25°. "Density-curves" are also given for the various mixtures, *i.e.*, curves showing the dependence of the densities of the liquid and saturated vapour of the same composition on the temperature. All the mixtures with concentrations between those corresponding with the minimal critical temperature and with pure methyl alcohol exhibit retrograde condensation of the first order; that is, the critical temperature is not the highest point of the curve, but lies at a transition point. On representing critical temperature as a function of the composition, the critical line is convex towards the axis of compositions, and exhibits a flat but distinct minimum. At the same position the boiling-point curve of the mixtures also exhibits a distinct minimum, indicating strong polymerisation of the methyl alcohol, which persists at the critical point. Consideration of the critical lines of mixtures already investigated shows that, although all the five forms given by Roozeboom occur, the rectilinear type predominates, Straus and Pawlewski's law being thus justified. T. H. P.

1325. *Contributions to the Knowledge of van der Waals' ψ Surface. X. Prediction of Properties of Mixtures from those of Components.* **J. E. Verschaffelt.** (Konink. Akad. Wetensch. Amsterdam, Proc. 8. pp. 743–752, April 24, 1906.)—The author uses van der Waals' equation with his relations between the *a*'s and *b*'s. Formulæ are derived for T*k* and *pk* which are compared with experimental results by Brinkman for CH_3Cl-CO_2, with satisfactory agreement. The conditions are then obtained for minimum critical temperature and maximum vapour pressure. It is shown that a minimum vapour pressure is only found with an anomalous substance, as found experimentally. Values are given for the plait-point line constants for CO_2–H_2, and are compared with Hartman's. There are diagrams.

H. H. F. H.

1326. *Molecular Attraction.* V. **J. E. Mills.** (Journ. Phys. Chem. 10. pp. 1–38, January, 1906.) [See also Abstracts Nos. 2062 (1902) and 1606 (1905).]—The equation previously given [Abstract No. 561 (1905)] holds well for both non-associated and associated substances, so that association depends on molecular attraction. In deriving the above expression, no assumption is made concerning the ultimate nature of molecules excepting that the law of gravitation holds between them. For methyl and ethyl formates and methyl acetate, the value of μ' is quite constant from 0° to about the critical temperature, in the neighbourhood of which divergences appear, probably owing to the inaccuracy of Biot's formula by which the vapour pressure was calculated. Chloroform, acetone, carbon disulphide, and ammonia also give constant values of μ'. The values for carbon dioxide, nitrous oxide, and sulphur dioxide diminish greatly as the critical temperature is approached, but this is probably due to inaccuracies of the measurements. Crompton's expression for calculating the heat of evaporation appears to hold with greater accuracy at high temperatures, the values it gives at low temperatures being too high. T. H. P.

1327. *Organic Solvents and Ionising Media.* III. *Viscosity in relation to Conductivity.* **P. Walden.** (Zeitschr. Phys. Chem. 55. pp. 207–249, April 6,

1906. Phys.-chem. Inst. des. Polytechnikums, Riga, October, 1905.)—Values are given for the viscosities of thirty-one different solvents, the ionising properties of which had been previously examined by measuring the electrical conductivity of tetraethylammonium iodide $N(C_2H_5)_4I$ in the different solvents; it is further shown that dilute solutions of this salt ($v < 200$) have the same viscosity as the pure solvent. The chief results of the investigation are as follows:—(1) The product of the viscosity of the solvent, η^{25}_{∞}, and the molecular conductivity of the iodide at infinite dilution, Λ^{25}_{∞}, is a constant, so that $\eta^{25}_{\infty} \times \Lambda^{25}_{\infty} = 0{\cdot}70$, approximately. Thus in twenty-four cases out of thirty the product lies between 0·64 and 0·76, and the exceptions are possibly due for the most part to experimental difficulties; thus the glycol solution, $\eta\Lambda = 1{\cdot}32$, has so little conductivity that the Λ_{∞} value is uncertain, whilst formamide ($\eta\Lambda = 0{\cdot}802$) and lactonitrile ($\eta\Lambda = 0{\cdot}860$) are themselves conductors and give doubtful values for Λ_{∞}. Water, however, is definitely an exception to the rule, and gives $\eta^{25}_{\infty}\Lambda^{25}_{\infty} = 1{\cdot}00$. (2) The temperature-coefficients of fluidity and of electrical conductivity are substantially identical. [In the case of aqueous solutions this rule holds good only for the less mobile ions.] The product $\eta_{\infty}\Lambda_{\infty}$ has therefore the same constant value 0·70 at all temperatures, as is shown by a table for nineteen solvents at 0° C. [See also Abstract No. 806 (1906).] T. M. L.

1328. *Velocity of Decomposition of Nitric Oxide.* **K. Jellinek.** (Zeitschr. Anorg. Chem. 49. 2. pp. 229–276, May 14, 1906. Phys.-chem. Inst. d. Univ., Berlin, March 7, 1906.)—Between 650° and 1,750° the reaction $2NO \rightleftarrows N_2 + O_2$ is bimolecular in both directions. The ordinary equation $\log k = -A/T + B$, showing the connection between the velocity-constant and the absolute temperature, and which has been found in most cases to give good results at comparatively low temperatures, completely fails in the present case. It must be replaced by the equation $\log k = AT + B - C/T$, which at high temperatures (as in the present case) simplifies to $\log k = AT + B$. In contradiction to former results it is found that decomposition of NO takes place at temperatures below 1,200° within measurable time; this holds for temperatures as low as 670°. The author has verified Nernst's result [see Abstract No. 3215 (1904)] that at 1,600° the equilibrium concentration of NO in the presence of atmospheric air is 0·42 vols. per cent.; at 1,750° it lies between 0·8 and 0·52 vols. per cent. From a knowledge of the values of k, derived from the equation $\log k = AT + B$, the "time of heating" in explosions of Knallgas with air is calculated to be of the order 10^{-4} sec. at 2,580°–2,675° abs. and atmospheric pressure. The time is also calculated which is necessary to decompose NO at atmospheric pressure to the extent of one-half; in the interval from 900° abs. to 3,200° abs. the time is reduced to one-billionth of its value. On the other hand, in the formation from air at atmospheric pressure of one-half of the possible amount of NO, the same variation in time occurs between 1,500° and 3,200° abs. The catalytic action of platinum and iridium on the reaction was also verified. [Errata, Ibid. 50. 1. p. 100.] T. S. P.

1329. *Electric Preparation of Colloidal Metals.* **T. Svedberg.** (Ber. Deut. Chem. Gesell. 38. pp. 3616–3620, 1905.)—Colloidal solutions of Sn, Au, Ag, and Pb in various organic solvents have been obtained by suspending the metal therein in the form of thin foil, and electrolysing between Fe or Al electrodes, with a p.d. of 110 volts and a current density so small that it could scarcely be measured by an ordinary ammeter. Extremely hard metals cannot be disintegrated by this method, but colloidal solutions of Mg, Zn, Al, Sn, Sb, Fe, Ni, and the alkali metals have been prepared by suspending the metal in the solvent in a granular form or as wire clippings, and attaching the electrodes to the secondary poles of an induction coil, to which is connected a glass condenser of 225 sq. cm. surface. The solutions of sodium are violet, those of potassium bluish-violet, thus supporting Elster and Geitel's view that the colourations produced by kathode or Tesla rays on alkali chlorides are due to colloidal solutions of the metal in the alkali chloride. W. H. Si.

1330. *Anodic Solution of Hydrogen and its Passivity.* **O. Sackur.** (Zeitschr. Phys. Chem. 54. pp. 641–664, March 13, 1906.)—The anodic solution of hydrogen is a slow process, and with constant voltage its velocity, measured directly by the current, diminishes, the diminution being the more rapid at higher voltages. On raising the voltage, the current first rises to a maximum at about 0·7 volt, and then falls to a very small value. This behaviour of hydrogen resembles completely the passivity of metals. All the observed phenomena are explained by the theory that the transition of electricity to the anode takes place by discharge of the anions, the anodic oxidation of hydrogen depending on its combination with the discharged oxygen owing to the catalytic action of the platinum electrodes, and that this latter is greatly diminished by the anodic charging with oxygen. Indeed, direct experiment shows that the union of hydrogen and oxygen is only accelerated by platinum charged with hydrogen, whilst when charged with oxygen, platinum has only a slight catalytic action. The kathodic reduction of oxygen, which is accelerated by charging the electrode with hydrogen, is also dependent on the union of oxygen and hydrogen after the discharge of the ions travelling to the electrode. T. H. P.

1331. *Electrolytic Preparation of Alcoholates and Alcoholate-carbo-acid Esters.* **B. Szilárd.** (Zeitschr. Elektrochem. 12. pp. 390–395, June 1, 1906. I. Chem. Inst. d. Univ., Budapest.)—In order to remove all traces of aldehyde and water from his ethyl and methyl alcohols, the author mixes the alcohol with freshly prepared silver plumbite, and, if necessary, with some metallic sodium, and dehydrates over CaO. Metallic sodium is then dissolved in the alcohol and the electrolysis effected in U-tubes with electrodes of Pt-foil, or also of Mg, Pb, and other metals; good cooling and absence of traces of water are essential. Alcoholate solutions of 4 per cent. answer best. Alkali alcoholate yields with electrodes of Pt or carbon sodium methyl (or ethyl) carbonate; the electrolysis with other metals yields at low current density the alcoholate of the metal, *e.g.*, magnesium ethylate; at high current density the ester, *e.g.*, magnesium ethyl-carbonate; at intermediate densities mixtures of the two. Long-continued electrolysis always gives the ester, even at low current density. H. B.

REFERENCE.

1332. *Influence of Light on Supersaturated Crystalline Solutions.* **M. Trautz** and **A. Anschütz.** (Zeitschr. Phys. Chem. 55. pp. 442–448, May 18, 1906. Chem. Lab. d. Univ., Freiburg, Jan., 1906.)—A historical summary is followed by an account of experiments with barium chlorate and bromate, potassium nitrate, sodium sulphate and chloride, ammonium chloride, copper sulphate. With $BaCl_2$ the illuminated solutions appear to crystallise quicker. H. H. F. H.